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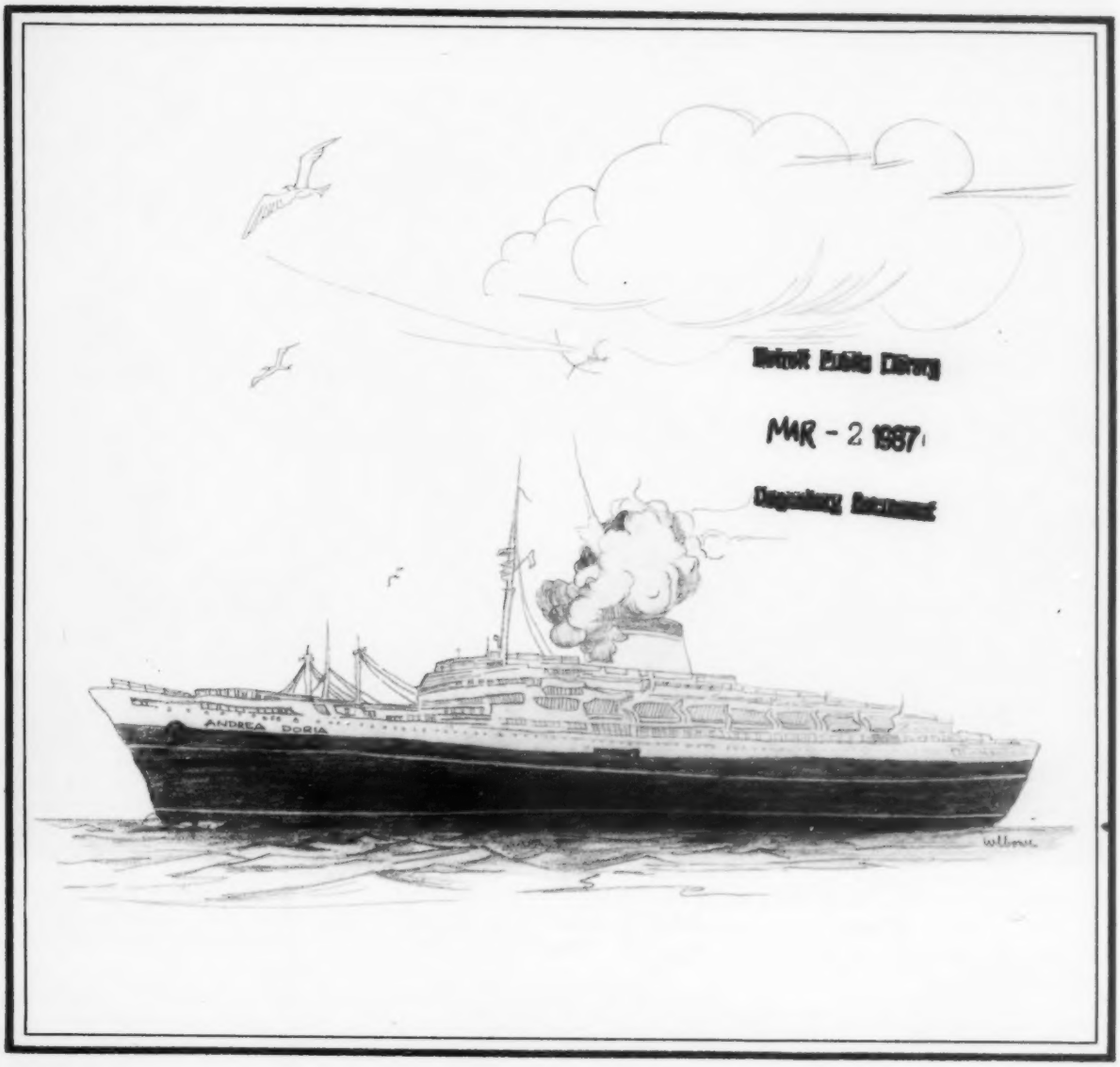
Mariners Weather Log



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Typhoon Lola and hurricane Namu flank the equator in a near mirror image in this unusual shot on May 18, 1986. Namu's maximum winds eventually reached 80 knots, but it was a tropical storm in this photo. Lola was already at typhoon strength, however the storm went on to supertyphoon intensity as maximum winds reached 150 knots.

The sea-level response to this cyclone pair appears in island tide gauges and satellite radar altimeter observations as a 20- centimeter amplitude Kelvin wave. This wave propagated eastward along the equator, from the point of origin to the west coast of South America in approximately 2 months time. More information on these waves appears in the December 2, 1986 issue of EOS (Chaney et al). Research is also underway to link this event with a possible El Nino.

This photograph was submitted by Ted Tsui of the Naval Environmental Research Prediction Facility.

Mariners Weather Log

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EDITOR:
Richard M. DeAngelis

GRAPHICS:
Wilhelmenia L. Bowe

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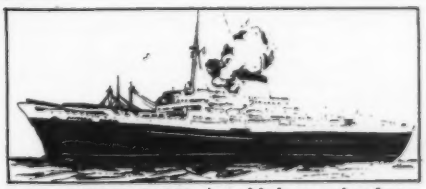

The ANDREA DORIA in all her splendor.

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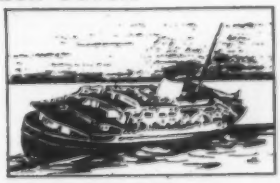


The ANDREA DORIA after the disaster.

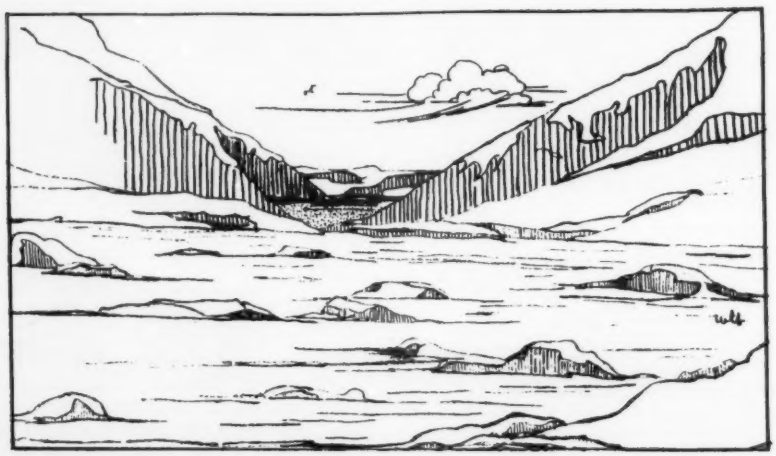
TALES OF THE WILD OCEAN

Article by Jerry LeBlanc

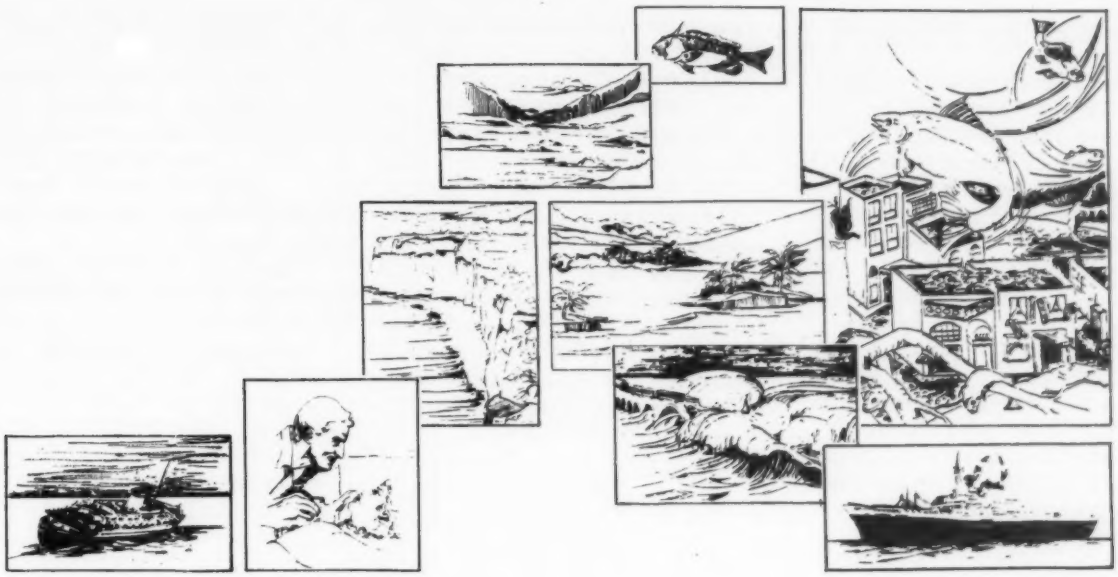
Illustrations by Wilhelmenia L. Bowe

The Monster Wave

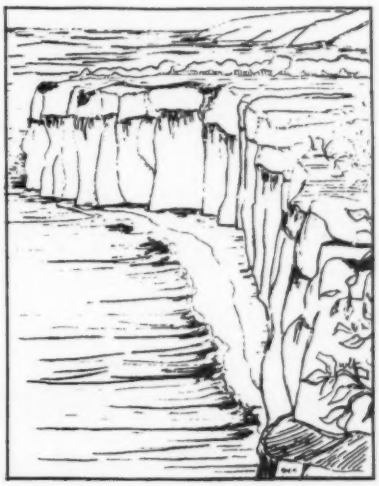
Late on the bright evening of July 9, 1958, the fishing trawler SUNMORE plied the Pacific inlet known as Lituya Bay on the southeastern coast of Alaska, near Juneau, a place where mile-high mountains and glaciers meet the sea. Ocean liners regularly cruise such bays to show passengers the spectacle of tiny icebergs dotting the sea for miles, but on that night only the SUNMORE hugged the shoreline, observed by other fishing vessels farther out to sea. Abruptly, a crumbling noise roared around the bay as some 90 million tons of rock and ice (apparently triggered by distant earth tremors) broke loose from a 3,000-foot precipice and plunged in a single mass down to the bay. It was the rough equivalent of dropping a bag of cement into a bathtub.



The resulting wave, rising an estimated 1,800 feet high, swept across Lituya Bay at a speed of more than 100 miles an hour. The fishing vessel,



SUNMORE disappeared without a trace. The wave struck mountains on the other side of the bay with such force that trees, shrubs, and the very earth itself were wiped away --all that was left was bare rock up to a height of 1,720 feet. Witnesses aboard other vessels detailed the event in reports to the United States Coast Guard, and the size of the wave was verified by surveying instruments sighted on the high-water mark left on the cliff. Scientists call it the highest wave in the recorded history of the ocean. Had such a wave struck a heavily populated



seaport, the destruction would have been uprecedented. Some argue that it was not a wave but rather a kind of splash, perhaps a spurious distinction since the sea takes all its motion from other forces, reacting to lunar, atmospheric, or other natural influences. When the impulse for change comes from an earthquake, volcanic activity, hurricane, or other storm, the result can be spectacularly violent. Or, at times, strangely benevolent.

Reprinted from Oceans, July-August, 1986.

Jerry LeBlanc has written more than 800 magazine articles and several books.

The Midnight Transfer

Consider the story of Linda Morgan, a dark-haired teenager sailing aboard a luxury liner off Nantucket on the night of July 25, 1956. Her ship: the ANDREA DORIA. Linda and her younger sister Joan went to bed early, right after the family dined with the captain. Her berth was Cabin 52 on the liner's upper deck on the starboard side. Her mother, Jane Cianfarra, and stepfather, Camille Cianfarra, a New York Times foreign correspondent, occupied an adjoining cabin. Linda slept soundly that night. Outside her porthole, waves surged mightily. Fog was thick and visibility near zero. Midnight approached. So did a ship called the STOCKHOLM.

The two ships collided, the weather-tossed STOCKHOLM ramming the ANDREA DORIA amidships in a deafening clash of steel that destroyed its own prow and left the ANDREA DORIA mortally wounded, listing and sinking.

Linda Morgan's cabin was right at the point of impact and took the full force of the ships' collision. Her sister, Joan, immediately plummeted into the sea and perished. In the next cabin, her stepfather was crushed to death. Her mother, badly injured, was trapped for hours in the wreckage. It was a night of panic and confusion aboard the ANDREA DORIA. Fifty-one persons died, most of them killed instantly. Scores were injured and missing, and the call arose to abandon ship. Linda, who was known to have been in her cabin, was entered on the list of missing and presumed dead. After all, her entire cabin had been crushed and obliterated. Her body was nowhere to be found. Yet she awoke, unaware that there had been a collision, asking, "What happened? Where am I?"

"You're on board the STOCKHOLM," a deckhand told her.

"Impossible," she said. "I'm a passenger on the ANDREA DORIA."

"What happened? Where am I?" "You're on board the STOCKHOLM," a deckhand told her. "Impossible," she said. "I'm a passenger on the ANDREA DORIA."

What had happened, it subsequently was pieced together, was that the knifelike prow of the STOCKHOLM had sliced into Linda Morgan's cabin just under her berth. The girl was lifted up, mattress and all, as the Scandinavian vessel retreated with the motion of the sea and carried her away safely on its bow. Some "benevolent" wave had hoisted both ships to precisely the right elevation to snatch her from the jaws of death. Her story was told on the wires of United Press International and on network radio by her own father, Edward P. Morgan, an ABC newscaster who earlier had received the report that she was dead.

In his broadcast, he said: "Last night, as far as the world at large was concerned, a girl, age 14, nationality American, named Linda Morgan, was dead. She happens to be this reporter's daughter. She had been killed, by the incontrovertible evidence of an eyewitness ... But Linda is not dead. She was hurled, one can only deduce, by the impact, from her bunk into the wreckage of the bow of the STOCKHOLM where she was found alive ... " The word Morgan used was "miracle."

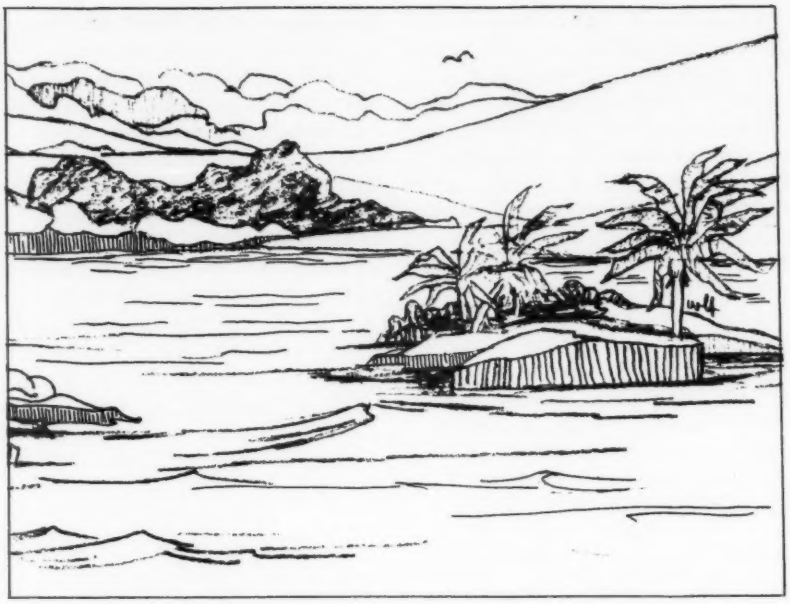
Mantas from Heaven

The bounty of sea can be diverse. In another rare event, one noted more for oddity than odds, the village of Oban, near Glasgow, Scotland, was inundated in the early part of this century by fish. Amid a violent rainstorm, as chronicled in a Scottish Daily Mail report on May 28, 1904, fish began falling from the sky, tons of them in every size and variety. Startled villagers thought the world was coming to an end as fish piled up ankle-deep in the streets. The fish covered everything, even the rooftops.

Ironically, the main industry of the

village was fishing, and the sky had collaborated with the ocean to give the villagers their biggest catch ever. Scientists theorized that the storm had spawned offshore waterspouts--seagoing tornadoes--that had sucked up countless thousands of fish and then dumped them ashore on top of the village. One meteorologist who reported on similar incidents in which it appeared to rain lizards and frogs miles inland, W.S. Kals, said, "Waterspouts are not merely seagoing dust devils. They have been seen to go ashore and act in every way like other tornadoes. There is another proof of their changing personality. Tornadoes have deposited schools of fish--fresh and saltwater species--not just pondloads of frogs."

That rain of fish is not an isolated case, according to the Center for Short Lived Phenomena at Cambridge Massachusetts. Says Richard Golob, the center's director, "There have been a number of such reports from time to time."



Islands on the Move

The center, which provides information to scientists worldwide, keeps track of nature's rarest mysteries, like the birth of islands, the beaching of whales, strange animal migrations, and other unpredictable, transient events deemed worthy of study.

From the center's files comes the story of floating islands, another quirky gift from the sea. On the northern coast of South America, where the sea meets the jungle, some huge, uninhabitable marshes teem with vegetation and impossibly tangled roots, trees, vines, and mosses, all anchored more to themselves than to earth. Storms send the sea reaching far into these marshes, and large sections are wrenched free and set sailing on the Caribbean. With palm trees as masts and fronds as sails, these unchartable isles drift until torn asunder by wind and wave. Captains of more orthodox vessels have sighted them and logged them with befuddling notes on their course and speed.

Tsunami

Despite occasional whims and gestures of beneficence, the ocean is best known for its spectacular violence. The tsunami is among its most devastating blows.

One of the largest known tsunamis occurred in broad daylight on June 15, 1896, at Sanriki, Japan, on the main island of Honshu. It is described in the book, Havoc, the Story of Natrual Disasters, by William Bixby. An earthquake rumbling in the distant Tuscarora Deep sent the surf at Sanriki into a spec-

tacular withdrawal from the coast, an unheard-of event that riveted the gaze of the thousands of people who were massed on the shore preparing for a religious festival. Minutes later, a wave 100 feet tall crashed into the land, drowning an estimated 28,000 people and washing away entire villages.

Revolutionary Storms

The most destructive oceanic event on record, according to James Cornell, a former associate of the Center for Short-Lived Phenomena who wrote The Great International Disaster Book, was a storm that killed one million people, eradicated dozens of villages without a single survivor, sparked a revolution, and directly led to the creation of a new country, Bangladesh.

A cyclonic hurricane in the Bay of Bengal on November 13, 1970, sent that arm of the Indian Ocean on a high rampage that swallowed offshore islands and inundated the East Pakistan coastline, burying it fathoms deep, rushing inland driven by 100-mile-an-hour winds. Thousands were buried alive; thousands more were washed away to sea. Some bodies were found in trees. When the government ignored survivors and delayed relief efforts, the people arose in revolt, winning a war of independence and establishing their own state separate from Pakistan, now known as Bangladesh.

A less powerful hurricane is charged with doing in a major Texas port and altering the history of the entire state. Galveston, a burgeoning Gulf of Mexico port at the turn of the century, was swamped in September 1900, when a West Indies hurricane propelled a tidal wave across the city, drowning it to a depth of 16 feet, and causing the loss of 5,000 lives and $17 million in property damage.

"Such tidal waves are no stranger to the Gulf Coast."

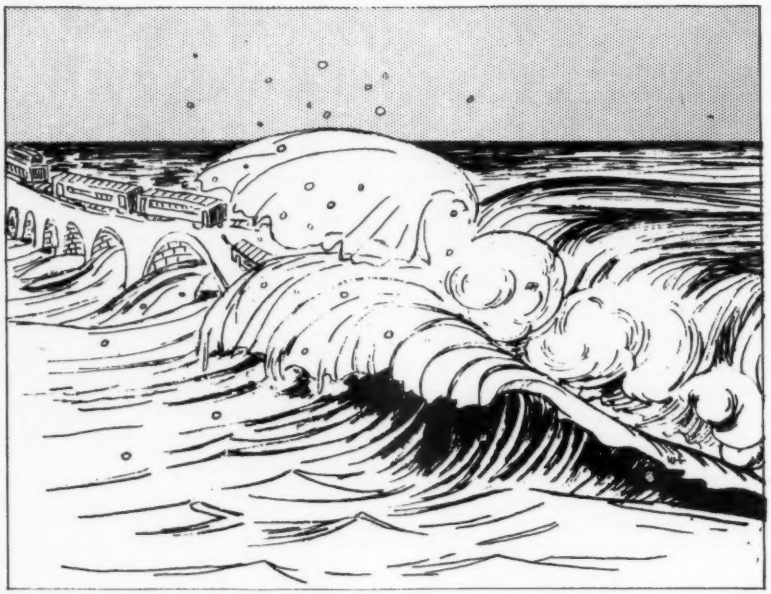
The city was rebuilt the next year on a higher level, just in time for the first major Texas oil strike, at the Spindletop oil field, but much of the booming growth that might have been Galveston's went instead to Houston, which was farther inland and preferred by once-ocean-burned, twice-shy investors.

Such tidal waves are no stranger to the Gulf Coast. One August night in 1856, the ballroom of the Trade Wind, a splendid beachfront hotel, at Isle Derniere, Louisiana, was jammed with several hundred southern belles and their beaux, dancing in luxury while outside a storm raged. Just before midnight a tidal wave crashed ashore, sweeping away 300 people and the entire hotel.

Riders to the Sea

One of the worst storms ever to hit the United States, the "Labor Day hurricane", swept a passenger train with all its riders into the sea on September 2, 1935. It happened in the Florida Keys, where holiday vacationers dallied despite reports for more than a week that a powerful hurricane hung over the Bahamas to the east. Meteorologists' instruments failed in the 150-mile-an-hour winds; they estimated that gusts were reaching 200 miles an hour.

On Labor Day, as the hurricane swelled in intensity and began to move toward the tip of Florida, the Florida East Coast Railway, which operated the only service from the low-lying Keys to the mainland, packed a ten-car train for one last run to safety. The tracks ran on a



stone causeway normally standing 30 feet above water level, and as the train inched its way across the spans, waves broke over the tracks. On its longest reach, past the point of no return, the train was slammed by a huge wave that broke 20 feet above it. Locomotive, passenger cars, tracks, and the causeway were thrown into the rampaging sea.

Rescue was impossible because the Keys were cut off for three days. The sea pounded the railway cars into flotsam and washed away passengers by the dozens as the full force of the storm bore down. It was estimated that approximately 150 persons died on the train, but an exact count was impossible because of the confusion of their last-minute flight. Hundreds of others died in the Keys and on the mainland, and scores had to be listed as "missing."

Paved with Tilefish

Marine ecologists might consider an event of 1882 to be among the greatest of all ocean catastrophes. That year, one and a half billion dead tilefish were seen floating on the surface of the Atlantic.

The colorful, basslike fish, which grows to over 30 inches in length and weighs up to 50 pounds, occupies depths between 300 and 1,200 feet, roaming the Atlantic from Nova Scotia to Florida and the Gulf of Mexico, feeding on crabs on the ocean floor.

According to the reports of ships' captains crossing the Atlantic in 1882, the bodies of the tilefish (Lopholatilus chamaeleonticeps) formed a mass stretching over 7,500 square miles from the American coast deep into the North Atlantic along the Gulf Stream. The mass die-off of these fish challenged marine scientists for decades. No cause of death could then be determined, and initially it was believed the species had become extinct in one fell swoop.

Years later, during World War I, when tilefish had somehow replenished their numbers, experiments by government fisheries indicated that the tilefish is delicately adapted to a very narrow range of water temperatures--between 47 and 50 degrees Fahrenheit. It was theorized that a sudden slight change in temperature at the level of their natural habitat had doomed over a billion of the creatures. Such changes are known to occur, but what caused the fatal change in temperature remains the subject of speculation.

It is not only the

"Greed turned these paleontological finds mostly into piano keys and billiard balls"

surface of the sea and the points where it contacts land that demonstrate the power of the ocean; beneath that surface wide rivers run, volcanoes, erupt, landslides roll down submarine mountain ranges, and plates of the earth itself grind together in thousand-mile rifts. George Cuvier, widely acknowledged as the founder of vertebrate paleontology, once said, "Life on earth has often been disturbed by terrific events. Numberless living beings have been the victims of these catastrophes, such violent sweeps that entire races of living beings have been extinguished forever and have left no other memorial of their existence than some fragments which the naturalist can scarcely recognize." Cuvier, attached to the Museum of Natural History in Paris in the early 19th century, made few field trips himself but his renown in the earth sciences and comparative anatomy caused explorers and scientists from all over the world to send him specimens for identification and interpretation.

Island Hopping

Cuvier described a disaster on an island far north of the Pacific Ocean, in an area off Siberia now called the Laptev Sea. The earliest scientific exploration of these areas, in 1805 and 1806, turned up surprising evidence of an oceanic cataclysm.

At a site on the Liakhov Islands, a deposit was discovered: a layer 200 feet deep of broken trees. Millions of trees appeared to have been wrenched out by their roots in one violent blow of nature. And, in the mud beneath the splintered wood were the broken and frozen bodies of millions of animals, some extinct and some contemporary. Ivan Liakhov, discoverer of the islands, reported, "Such was the enormous quantity of mammoths' remains that it seemed that the island itself was actually composed of the bones and tusks." Greed turned these paleontological finds mostly into piano keys and billiard balls; for a time the area supplied half the world's demands for ivory. Such vegetable-eating creatures as bison could not have existed in that polar climate, scientists agreed. In the stomachs of frozen animals was found undigested food not then grown within hundreds of miles. Fractured bones and other microscopic evidence pointed toward simultaneous death. Reconstructing the disaster, Cuvier presumed that several centuries earlier a giant wave had crashed ashore at some distant point on the mainland. When the wave drew back again, its force pulled countless animals through the crushed timber, which acted as a screen, tearing the creatures apart. The wreckage, washed away into the ocean, was deposited at the remote island location where it was discovered by scientific expeditions. □

The Pride of Baltimore

--by Jerome W. Nickerson
*Marine Weather Consultant

It was the 4th of July 1986. The celebration for the refurbished Statue of Liberty was spectacular, particularly the parade of tall ships (fig. 1). However there was an open space in this parade which lent a somber note to the festivities. The PRIDE OF BALTIMORE was missing. Nearly two months before, the PRIDE was enroute from a successful European goodwill voyage when she was hit by a sudden burst of high winds and sank within two minutes. Of the twelve-person crew, eight survived. Captain Armin Elsaesser III apparently went down with his vessel.

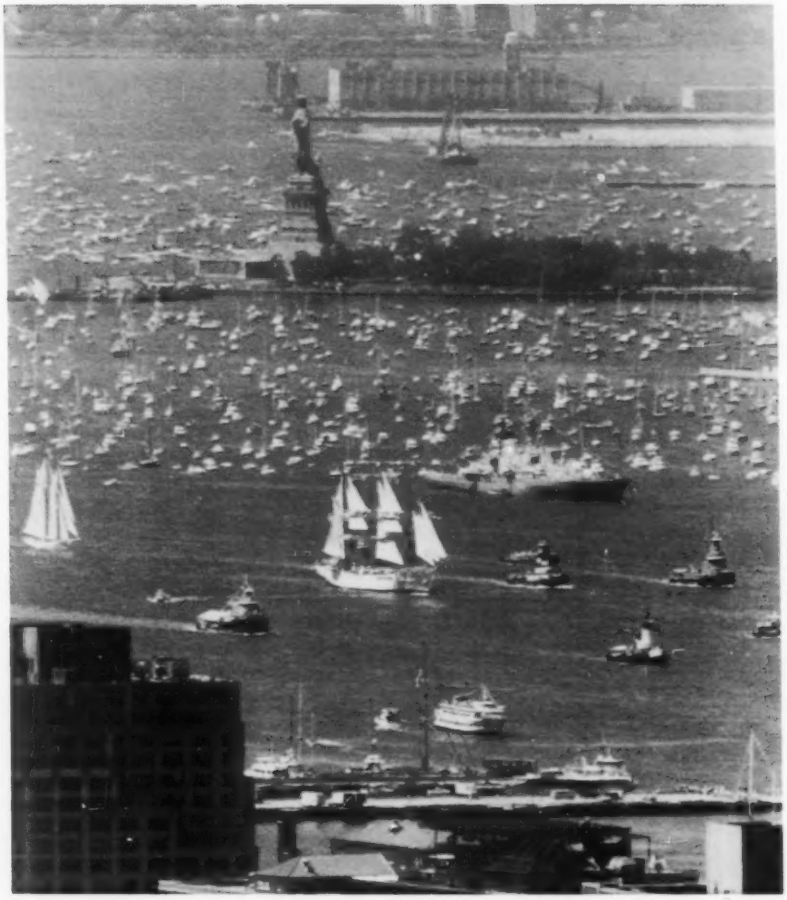


Figure 1. -- The Liberty parade without its leader.

* Now retired, Jerry was the Marine Observations Program Leader for NOAA. His address is RD2, Box 52 Purcellville, VA 22132.

The PRIDE OF BALTIMORE left St. John harbor on St. Thomas, U.S. Virgin Islands on May 12, 1986 bound for the mouth of the Chesapeake Bay and eventually her home port of Baltimore. Tragedy struck the second day out, at about noon. The PRIDE was running under shortened sail, in and out of rain showers, with 15 to 30 knots of wind. Only the studsail (the innermost jib) and the shortened or reefed mainsail (the aft gaff-headed sail) were up.

A line of dark clouds was sighted ahead and Captain Elsaesser called all hands on deck to take the second reef in the mainsail. A reef in a sail is made by tying a series of lines across the sail to the boom, as can be seen in figure 2. The PRIDE had three horizontal rows of these lines across the mainsail. Therefore, three reefs of the mainsail could be made, each time decreasing the area of the sail.

Fortunately, only one crewmember was below deck when the downburst or microburst of winds struck and the PRIDE was knocked-down. He escaped and became one of the eight survivors.

Figure 2. -- The PRIDE photographed by the late Captain Armin Elsaesser III.

Winds jumped from about 30 knots to as high as 90 knots. Within an estimated 20 seconds, the port gunwale and the lower part of the mainsail were in the water. Moments later, the PRIDE was in full knock-down with the ship on its side. In only 60 to 90 seconds the hull was flooded and the PRIDE was on the way to the bottom, three miles deep. The sinking occurred about 240 miles north northwest of San Juan, Puerto Rico, approximately 22°30N', 67°00'W, at between 1130 and 1200 EST on Wednesday, May 14, 1986. Eight of the twelve-person crew managed to get aboard one six-person raft. The other raft ripped on the rigging.

Although the survivors were in a busy sea lane, they were not rescued until May 19th, at about 2 a.m., 4 days and 14 hours later. They saw one aircraft and six ships and expended their flares and much energy trying unsuccessfully to attract attention to themselves.

This situation is not unusual. Unless there is a formal search underway, the crew of the aircraft are primarily concerned with aircraft control and navigation. Chance spotting of shipwreck survivors is extremely rare.

Aboard ships, with the minimum size crews, one person on the bridge is a common practice. Monitoring the functioning of the ship, the radar, and watching for other ship traffic doesn't allow much time to scan the 300 square miles of ocean that can be seen from the bridge.

The crew of the PRIDE had contacted their home base in Baltimore on May 9th from St. John, stating that they planned to be off Norfolk, Virginia on May 19th or 20th. At the Coast Guard inquiry a crew person stated that they felt they were in "home waters" so they suspended the daily routine of contacting other vessels to pass on their position. The PRIDE was a Voluntary Observing Ship (VOS), but had also stopped sending in weather reports.

"No one planned on a knock-down and sinking in less than 2 minutes."

On May 18th or 19th the people at the PRIDE's home base became concerned, because they could not contact the vessel by radio, and asked the National Weather Service to find the PRIDE's position from their most recent weather report. There were none.

On May 19th, the first news of the PRIDE's sinking came from the survivors who had been rescued by the crew of the Norwegian tanker TORO.

The PRIDE did have two Emergency Position Indicating Radio Beacons (EPIRB). Normally, an EPIRB is kept in a holder topside so it will activate and float free if a ship sinks. The PRIDE's EPIRB's were turned off and stowed, one in the forward main cabin, and one in the captain's cabin aft. Like the crew's lifejackets, which were stowed over their bunks, they were intended to be carried by the crewmembers to the liferafts when the crew abandoned ship in an orderly manner. No one planned on a knock-down and sinking in less than 2 minutes.

Had the EPIRB's been topside and activated by the ship sinking, other ships in the area would have known immediately and could have come to the aid of the survivors. There were about 10 vessels reporting weather through the area that day. The time difference of a few hours versus 4 days and 14 hours, before rescue efforts started, might have meant one or more additional survivors.

"The Baltimore Clipper"

Baltimore was famous in the 1800's for its Baltimore clippers. They were speedy, but difficult ships to sail. The 90-foot hull had an extremely long bowsprit and a boom that extended aft of the ship. The mainmast towered 90 feet above the water and they could carry almost 10,000 square feet of sail. The clippers were blockade runners and gadflies to the blockading British fleet in the war of 1812. The clippers could sail "with practically no wind at all" according to a British captain of a superior gunned warship that could barely make steerage.

The most famous was the CHASSEUR, which captured 18 enemy ships. The CHASSEUR was nicknamed the PRIDE OF BALTIMORE after her triumphant return to the city in 1815.

When Baltimore decided to build a sailing ship for public relations purposes the glamorous, historic clipper was an easy choice. The ship builders insisted that it be authentic in every detail. Even the beams were hand hewn and the iron fittings were made by a blacksmith on the site. The PRIDE was built in Baltimore Inner Harbor in 1976 and 1977.

Since then she has been visiting ports in Canada, the U.S., the Caribbean, and Europe extolling the virtues of Baltimore and the state of Maryland.

The PRIDE OF BALTIMORE is the third authentic replica of a sailing vessel to sink, with loss of life in recent years. The British barque, MARQUES, was lost off Bermuda with eighteen of her crew, and the Danish ship ACTIVE went down in the North Sea with a loss of nine. Many sailing experts have said that being authentic with the PRIDE ignored 150 years of technical advances in shipbuilding. Recreating an authentic 19th century ship recreates all the risks and faults of these ships as well as their glamour.

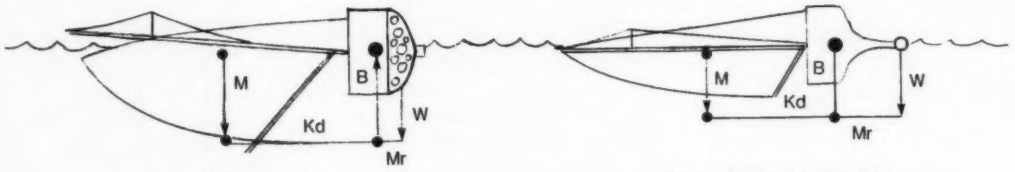
Sailing experts say the PRIDE may have suffered from being too ancient and too modern. The hull of the PRIDE, made painstakingly like the original, did not have an extended lead-footed keel to stabilize it like modern sailing ships. Like the original, the PRIDE carried iron bars, blocks of concrete, and cobblestones piled along the keel inside the hull for ballast.

The ship had no watertight bulkheads and the main cabin was entirely open. All hatches except the midship companionway were supposedly secured. There doesn't seem to be any ready answers to why the PRIDE sank so quickly. Possibly some of the blocks of concrete, or other ballast, fell from the up side of the hull and punctured the side of the ship.

On the other hand, Reese Palley, an ocean yachtsman and authority on offshore sailing, said that the sails and lines made of modern materials, but in the ancient rigging, were too strong. In the days of the old sailing ships, Palley said, fierce winds snapped ropes, ripped the sails and broke the masts. That reduced the wind resistance and the chances of the ship being blown on its side. The PRIDE's sails, mast and rigging held. Recent engineering studies indicated that the PRIDE did not have the stability to right itself after a knockdown. Once the masts and rigging were in the water, it was all over but the sinking.

Melbourne Smith, the PRIDE's builder and

"The Pride" vs Modern Yacht



"PRIDE" MODERN YACHT

The large weight and drag of the PRIDE's sail, mast, and rigging (M) produced so large a knock-down moment arm (K_d) that it was greater than the righting moment arm (M_r). M_r is proportional to the buoyancy of the hull (B), the weight of the ballast (W), and the distance between these centers of force. In a modern yacht the sails are lightweight, synthetic, non-wetting material. The mast and booms are light weight metal, often self floating. Rigging is light-weight wire, so M is small for the modern yacht. The ballast is in the foot of the keel, which is separated from the hull by some distance, giving the yacht a positive righting moment (M_r) so the yacht is self-righting. Knock-downs in modern yachting are not uncommon, particularly in the smaller ocean racers, but the modern yacht is watertight and extremely buoyant.

first captain, said he believes the accident "was just bad luck. If they had missed that weather they might have sailed on for years." It seems the choices were authenticity and luck, or safety and making it home.

As Captain Smith implied, if the PRIDE had not been at that place at that time that particular accident would not have occurred. However, downbursts are really not that unusual. From a paper I wrote for the Mariners Weather Log, "Freak Waves and Extreme Storm Waves", (Winter 1985, Volume 29, No. 1), figure 3 shows twenty five downbursts from one thunderstorm plotted by Dr. Theodore Fujita University of Chicago.

Figure 4 depicts the arcus cloud, under a severe thunderstorm. These clouds are often described as line squalls, by mariners. They are actually the visible indications of a downburst. The anemometer on the SELKIRK SETTLER jumped from near calm to 84 knots when the downburst struck. The conditions sound similar to those experienced by the PRIDE.

Captain Robert D. O'Brien, SCOTCH MIST II, a sailing yacht,

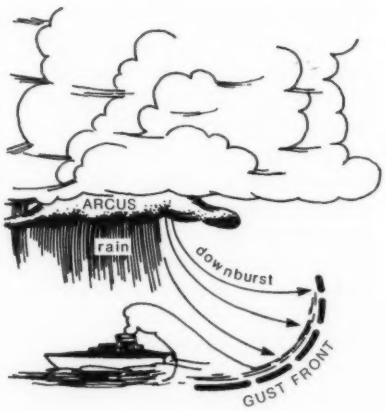


Figure 4. -- Cold dense air from the upper part of a cumulonimbus plummets downward and becomes a downburst when it strikes the surface and spreads out.

(MWL Summer 1985, Vol. 29, No. 3, page 151) in a letter to the editor reemphasizes that

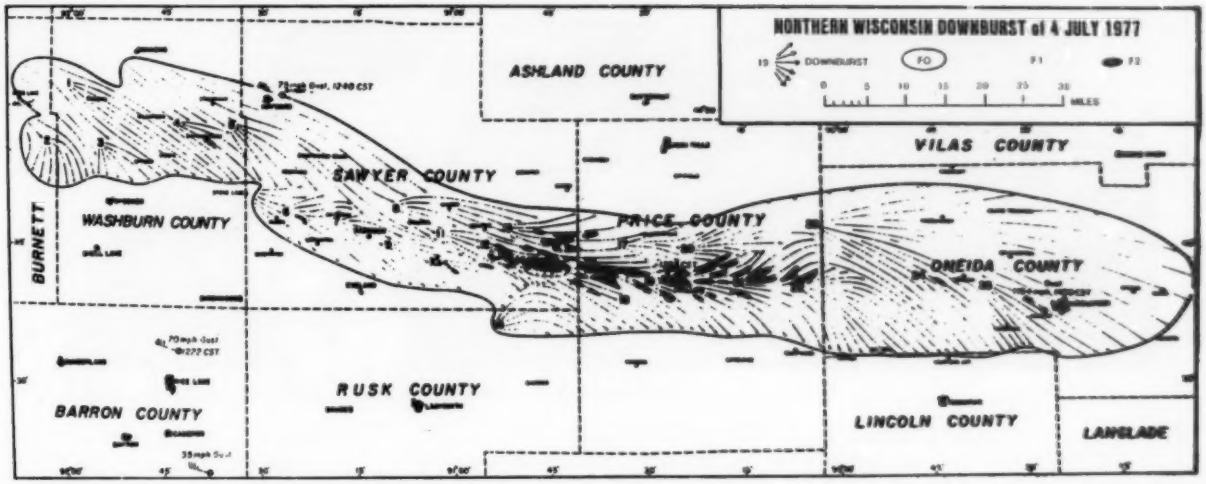


Figure 3. -- Downbursts on Indepenence Day in northern Wisconsin left behind a damage swath 166 miles long and 17 miles wide.

downburst winds may reach the ship at a high angle rather than being horizontal. As a sailing vessel heels over, it presents a broader angle of the sail to the high angle wind. Similar conditions may have caused the PRIDE to knock-down so quickly.

Raymond E. Biedinger, National Weather Service forecaster at Miami, Florida testified before the U.S. Coast Guard inquiry of the PRIDE sinking that the cause of the knock-down of the PRIDE "has all the indications that it was a microburst (small down-burst)." He said the offshore weather forecast for the area that morning indicated winds of 15 knots, based on reports from ships in the area and satellite photographs, with winds stronger in scattered thunderstorms.

The approximate position where the PRIDE sank is marked with a + on Figures 5 and 6, the 1200 (07LST) May 14 weather

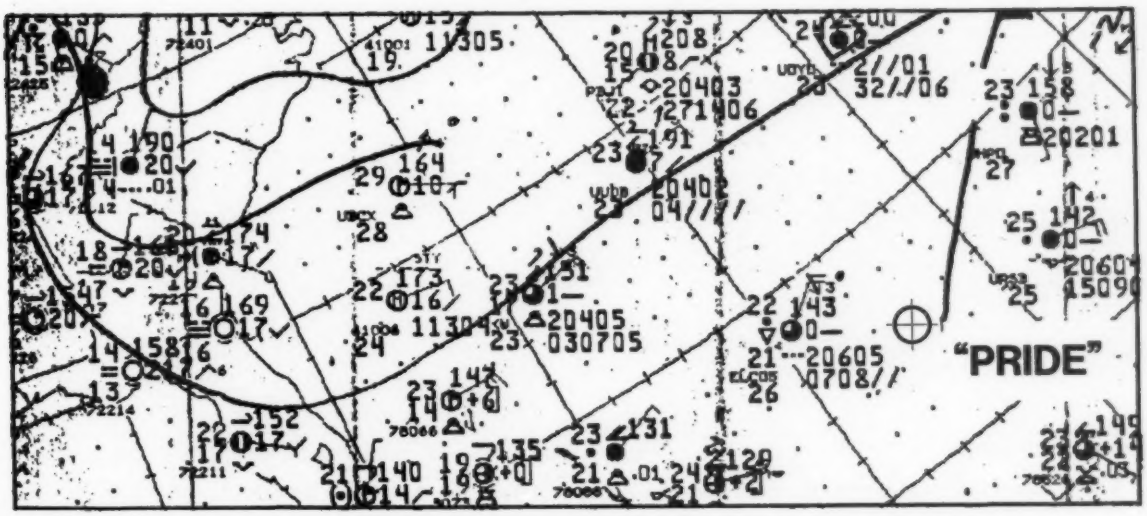


Figure 5. -- The 1200 weather chart with the approximate location of the sinking.

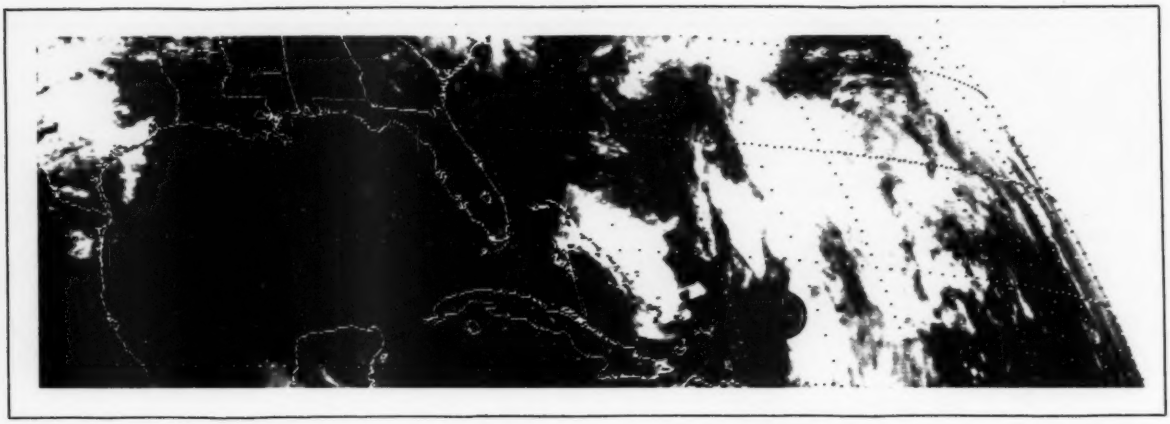
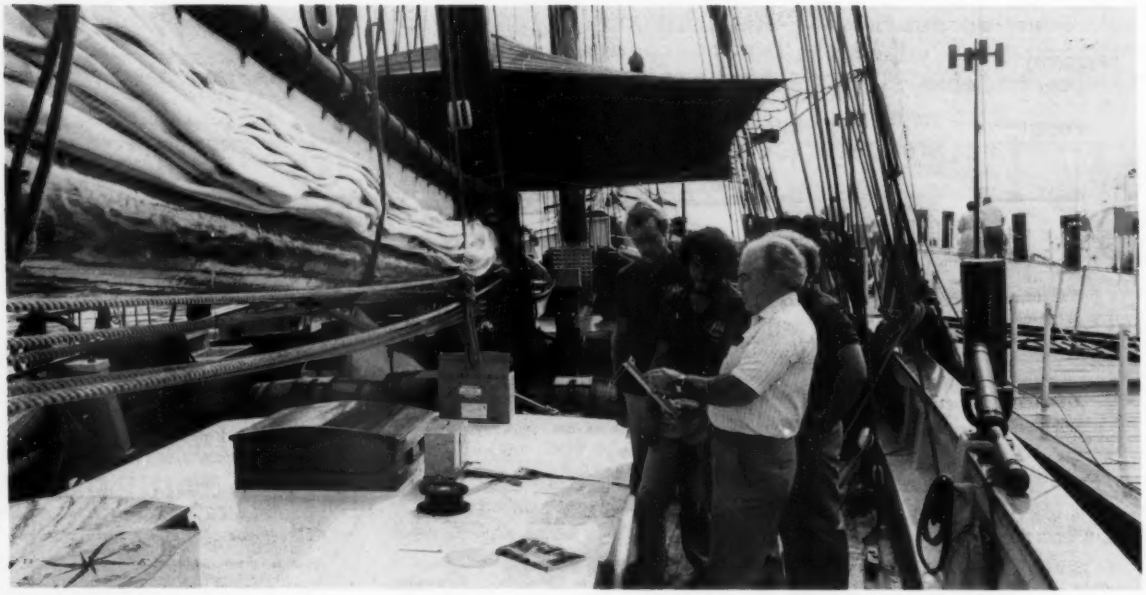


Figure 6. -- Weather situation from above at 1700 on the 14th.

map and satellite photo. The PRIDE was sailing through an area of slack pressure gradient with showers and cumulonimbus clouds all around. The whole area was ideal for downburst conditions where cold air from very high altitudes may plummet to the surface of the ocean. As the cold, dense air reaches the surface it spreads out as a strong, gusty wind. It may last from a few minutes to an hour or more. A narrow line of cumulus clouds, called a gust front, may form along the leading edge of the cold air outflow from large, persistent downbursts. The cloud line and the weather that followed, as described by the PRIDE crew, are classic gust front and downburst conditions.

Forecasting the occurrence of downbursts would be an impossible task because they are so short lived. About



A look back -- the author and the crew of the PRIDE discuss the "sea water temperature dip". The instruments, forms and books were used by the crew to take weather observations for the NWS.

the best that can be done is to forecast the area of showers and thunderstorms. It must then be left to the mariner's good judgement as to whether he thinks an individual thunderstorm that he sees visually or on radar will produce a downbrust.

We deeply regret the loss of the PRIDE of BALTIMORE, Captain Elsaesser, and the crew persons. However, by carefully examining the facts of this tragedy, a similar accident may be prevented. A lot has been learned and we thank the Pride of Baltimore Corporation, the Coast Guard, and the many others involved for their cooperation. □

The New PRIDE OF BALTIMORE

Pride of Baltimore, Inc. announced that a new sailing vessel will be built in response to the public sentiment expressed throughout the State of Maryland and from every port that the PRIDE has visited. This vessel will be an entirely different design but will carry the same name, in tribute to the captain and crew lost in the tragedy. She will be built in accordance with Coast Guard regulations for passenger carrying vessels. Thus she will be able to take people sailing, both on day cruises and longer voyages. There will also be a small saloon designed for meetings, dinners or luncheons. It is expected that the keel will be laid in the spring of 1987 and in the summer of 1988 a new PRIDE OF BALTIMORE will grace the Chesapeak Bay.

BACK ISSUES AVAILABLE

Mariners Weather Log

During our recent move we discovered that we had a number of boxes of past issues of the Mariners Weather Log. We are able to offer these copies, prior to 1986, at just $1.00 per issue. We do not have all issues. However if you would like to complete your collection please send us a list of the Logs that you are missing and we will send what is available and bill you at that time. Send to:

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NORTH ATLANTIC TROPICAL CYCLONES, 1986

Gilbert Clark and Miles Lawrence

During 1986 only six tropical cyclones came to life in the North Atlantic. Since 1930 there have been just nine seasons when less than seven tropical storms and hurricanes have developed (table 2). This season four were hurricanes and two were tropical storms

Efforts to discover and understand the factors controlling seasonal variation in tropical cyclone activity are mired in statistics. However, there are indications that sea-level pressure patterns, high-level winds and sea surface temperatures are all related to tropical cyclone occurrence.

Figure 1 shows the tropical cyclone tracks for 1986. There were two land-falling hurricanes, Bonnie near the Texas/ Louisiana border and Charley over the Outer Banks of North Carolina. The other two hurricanes, Earl and Frances, formed northeast of Puerto Rico. They were the only two tropical cyclones to affect the major shipping lanes of the North Atlantic. The Caribbean Sea remained

Table 1. -- 1986 hurricane statistics.

No.	Name	Class.[1]	Dates[2]	Maximum sustained Wind (kn)	Lowest Pressure (mb)	U.S. Damage ($millions)	Deaths
1	Andrew	T	6/05-6/08	45	999		1
2	Bonnie	H	6/23-6/28	75	990		3
3	Charley	H	8/13-8/20	70	987		5
4	Danielle	T	9/07-9/10	50	1000		
5	Earl	H	9/10-9/18	90	979		
6	Frances	H	11/18-11/21	75	1000		

1 T: tropical storm, wind speed 34-63 knots.
H: hurricane, wind speed 64 knots or higher.
ST: subtropical storm, wind speed 34-63 knots.

2 Dates begin at 0000 UTC are for tropical and subtropical cyclone stages.

Table 2. -- Summary of past years.

North Atlantic Tropical Cyclones

	Tropical Storms and Hurricanes										Hurricanes								
	M	J	J	A	S	O	N	D	Tot.		M	J	J	A	S	O	N	D	Tot.
		1	1	2	3	1	1		9	1931					2	1	1		2
	1			3	3	3			11	1932					1				6
		1	3	7	5	3	1		21	1933		1	1	3	3	1			9
	1	1	1	2	2	3	1		11	1934		1	1	1	1	1	1		6
				3	1	2			6	1935				2	1	2			5
		3	2	6	4	1			16	1936		1	1	3	2				7
			1	2	6				9	1937					3				3
		1		3	1	3	1		8	1938				3	1				3
	1			1	1	2			5	1939				1		2			3
				3	2	2			8	1940				3	1				6
					4	2			6	1941					3	1			4
				3	3	3	1		10	1942				3			1		6
		1		2	4	3			10	1943			1	1	2	1			5
		3		2	4	2			11	1944			2	1	3	1			7
		1		4	3	2			11	1945		1		1	1	2			5
		1	1	1	1	2			6	1946			1		1	1			3
			1	2	3	3			9	1947				2	1	2			5
	1			2	3	1	1		9	1948				1	3	1	1		6
				3	7	2	1		13	1949				2	4	1			7
				4	3	6			13	1950				2	3	4			11
(F)1	1			3	4	2			10	1951	1			2	3	2			8
				2	2	2			7	1952				2	2	2			6
	1			3	4	4	1	1	14	1953				2	3	1			6
		1	1	2	4	1	1	1	11	1954		1		2	3	1		1	8
			1	4	5	2			12	1955				3	5	1			9
		1	1	1	4	1	1		8	1956			1	1	1	1			4
		2		1	4	1			8	1957		1			2				3
		1		4	4	1			10	1958				3	3	1			7
	1	2		1	3	2			11	1959		1	2	1	3	1			7
		2		2	3				7	1960			1	1	2				4
			1	2	6	2	2		11	1961			1		5	1	1		8
				2	2	1			5	1962				1	1	1			3
		1		1	5	2			9	1963			1	1	4	1			7
	1	1		4	4	1	1		12	1964				2	3	1			6
				2	2	1			6	1965				2	1	1			4
		1	4	1	4	4	1		11	1966		1	3	1	1	1			7
				1	1	3	3		8	1967				1	3	2			6
	3			1	1	3	1		8	1968		2		1	1	1			5
		1		1	5	6	1		18	1969				4	4	3	1		12
	1	1		3	3	2			10	1970	1			1	1	2			5
			1	4	6	1	1		13	1971				2	4				6
	1	1		2	2	2			7	1972		1		1	1				3
			2	2	2	2			8	1973			1	1	1	1			4
	1	1	1	4	4	1			11	1974				2	2				4
	1	1		2	3	1		1	9	1975			1	2	3				6
(J)1	1		1	5	2	1			10	1976				4	1	1			6
				1	3	2			6	1977				1	3	1			5
		1	1	4	3	3			12	1978				2	2	1			5
			2	3	2	1			8	1979			1	2	2				5
				3	5	1	2		11	1980				3	3	1	2		9
	1	1		2	5	1	1		11	1981				1	5		1		7
		1		1	2	2			5	1982		1			1				2
				2	2				4	1983				3	1				3
				4	6	1	1	1	13	1984					2	1	1	1	5
			1	3	3	2	1		11	1985			1	3	1	1	1		7
		1		1	2		1		4	1986		1		1	1		1		4
(J)1 (F)1	12	31	43	140	191	98	23	4	544	Totals	2	13	20	90	120	61	13	2	311

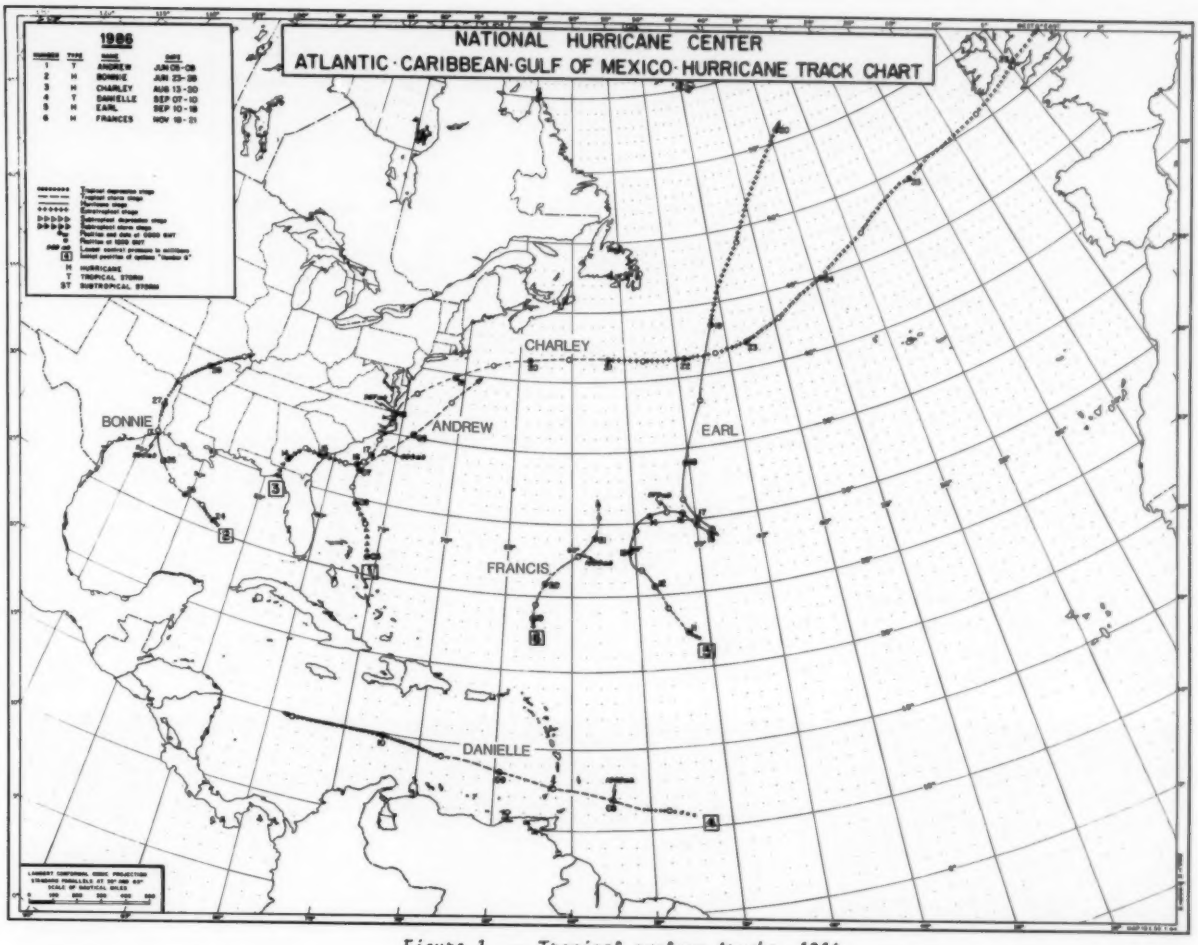


Figure 1. -- Tropical cyclone tracks, 1986.

free from hurricane activity for a record setting fifth straight season. Tropical storm Danielle moved across the Windward Islands into the Eastern Caribbean, but soon dissipated due to upper level wind shear. Table 3 lists ships encountering winds of 50 knots or more.

Tropical Storm Andrew

JUNE 5-8

A slow developing circulation near the Bahama Islands was designated a depression on June 5th. As the system moved slowly northward sustained surface winds increased to tropical storm strength (35 knots) on the 6th (fig. 2). Andrew recurved to the northeast, with its center passing 70 miles from Cape Hatteras before heading out to sea and dissipating off the New England Coast. Maximum sustained winds reached 45 knots on the east side of the storm as it passed near the coast. There was one drowning death but no reports of damage.

Hurricane Bonnie

JUNE 23-28

Bonnie was identified as a tropical depression on June 23d in the central Gulf of Mexico. The depression reached storm strength on the next day, when its center was located about 175 miles south of the Louisiana coast. Just

Table 3. -- Ships encountering tropical cyclone winds of 50 knots or more.

TROPICAL CYCLONE	VESSEL CALL SIGN	DATE MO DAY	TIME UTC	SHIP POSITION LAT.N	LON.W	WIND DIR (°)	SPEED (KN)	PRESSURE (MB)
ANDREW	(None)							
BONNIE	(None)							
CHARLEY	KMHF	08 20	0000	43.9	60.1	100	50	1007.8
	KMHF	08 20	1200	43.8	60.2	040	66	1008.8
	VSGB	08 20	1200	44.2	58.4	050	55	1007.2
	VAKB	08 23	1200	48.0	39.3	080	50	1005.3
DANIELLE	(None)							
EARL	ELAF7	09 18	2140	44.4	45.2	120	65	1004.0
	YJWG6	09 19	1200	46.5	39.0	180	55	1017.8
	ELDT6	09 19	1200	50.5	38.3	150	58	1006.0
	ELDT6	09 19	1800	51.3	36.8	180	55	1003.5
FRANCES	(None)							

a few hours later, a USAF reconnaissance plane reported a 68-knot flight-level wind speed and Bonnie was upgraded to a hurricane. The center crossed the coast near the Texas/Louisiana border early on the 26th (fig. 3).

A sustained wind speed of 67 knots with a gust to 85 knots was recorded at Sea Rim State Park on the Texas coast. An oil rig about 100 miles offshore observed 72-knot sustained winds. The lowest surface pressure was 990 millibars or 29.24 inches, recorded by the

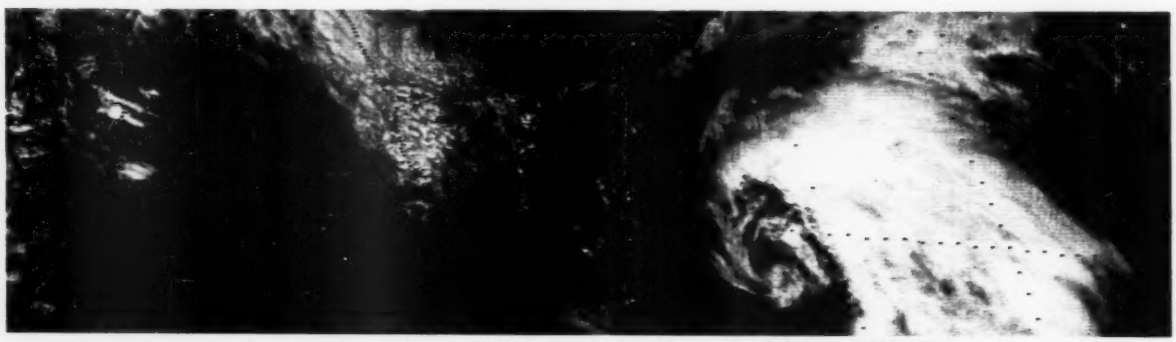


Figure 2. -- Andrew at 1631, June 5, north of the Bahamas. NOAA GOES.

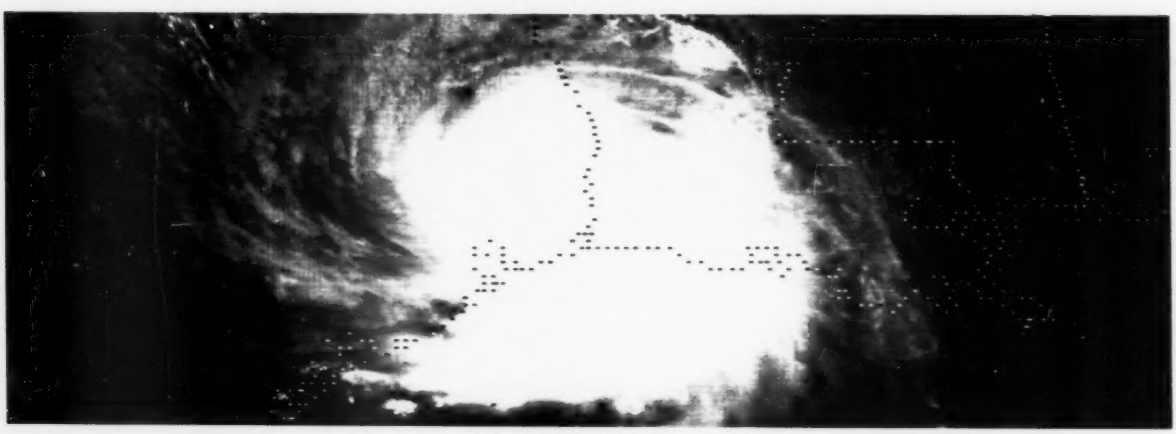


Figure 3. -- Bonnie at 1600 on the 26th over southeast Texas. NOAA GOES.

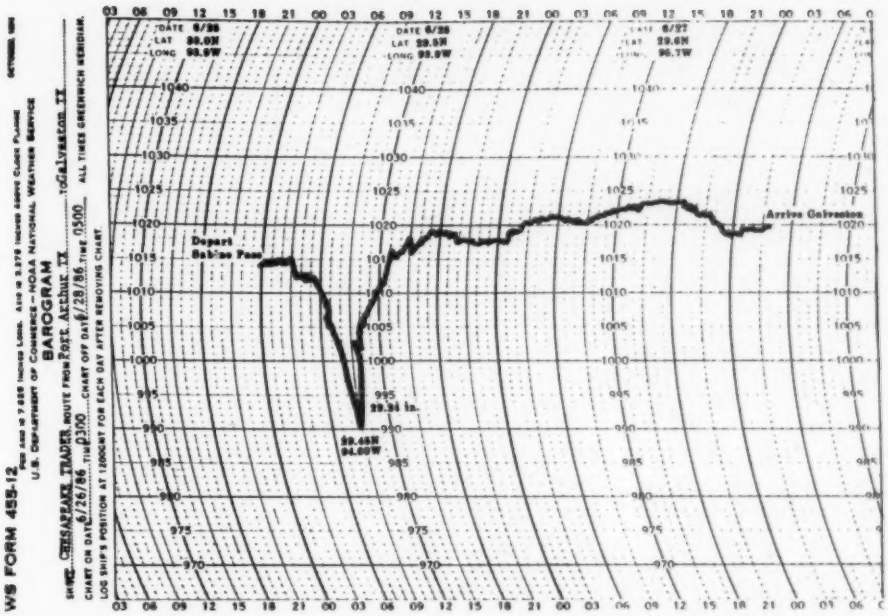

WS FORM 455-12
U.S. DEPARTMENT OF COMMERCE – NOAA NATIONAL WEATHER SERVICE
BAROGRAM
SHIP CHESAPEAKE TRADER ROUTE FROM Port Arthur, TX TO Galveston, TX
CHART ON DATE 6/26/86 TIME 0300 CHART OFF DATE 6/28/86 TIME 0500
ALL TIMES GREENWICH MERIDIAN
LOG SHIP'S POSITION AT 1200GMT FOR EACH DAY AFTER REMOVING CHART
Depart Sabine Pass
Arrive Galveston
29.34 in.
29.46N
94.60W

Figure 4. -- Barograph trace from the MT CHESAPEAKE TRADER as she passed through the center of Hurricane Bonnie.

Ship CHESAPEAKE TRADER just off the upper Texas coast (fig.4).

Storm surge water levels along the coast ranged up to a maximum of 5 feet above normal astronomical tide at Sabine Pass, Texas. Coastal flooding produced most of the $2-million damage estimate. There were three deaths in the Port Arthur, Texas area.

Hurricane Charley

AUGUST 13-20

A weak circulation was first detected from satellite pictures on August 12th, centered just west of Tampa, Florida. The weak circulation was tracked across the Florida panhandle, across Georgia and back offshore into the Atlantic on the 15th. It then strengthened to a tropical storm.

The storm turned

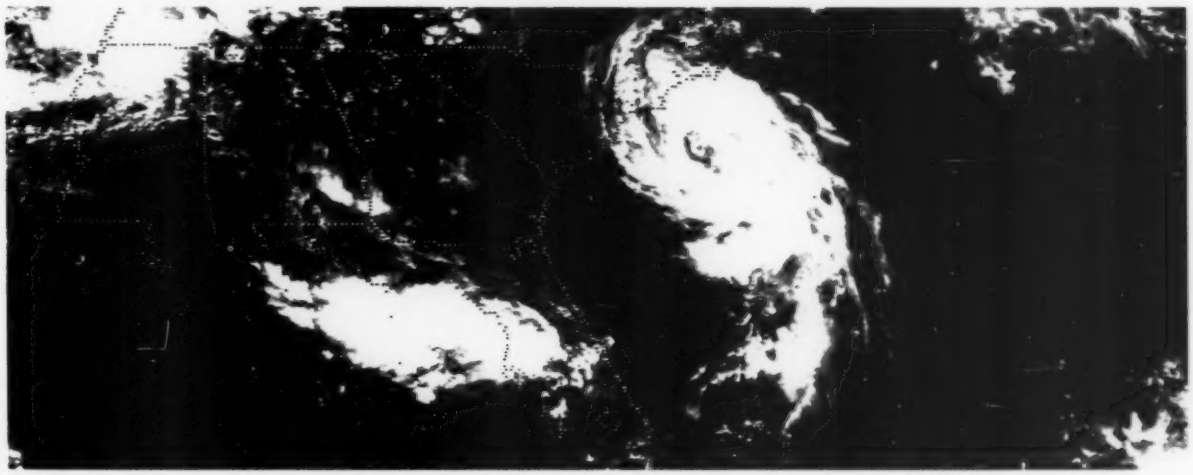


Figure 5. -- Charley off the North Carolina coast at 1630 on the 16th. NOAA GOES.

northward on the 17th and strengthened to a minimum hurricane just prior to moving across extreme eastern North Carolina (fig. 5). Charley moved backed over the Atlantic on the 18th. Its maximum winds fell below 74 miles per hour. The storm moved parallel to the northeastern U.S. coast before heading out to sea. Charley transformed into a large extratropical storm with gale-force winds spreading out several hundred miles from the center. The system moved across the North Atlantic shipping lanes and was tracked to the British Isles and Northern Europe by the end of August.

Maximum sustained-surface winds were observed in the 45- to 55- knot range along the coastal sections of North Carolina, Virginia, Maryland, Delaware and New Jersey, and on Nantucket Island, Massachusetts. The highest value was 85 knots sustained at the Cheasapeake Bay Bridge and Tunnel at South Island, Virginia. Reconnaissance aircraft measured flight level winds of 65 knots during the 18 hours that Charley was a hurricane. The lowest pressure was 987 millibars or 29.15 inches early on the 18th. No ships reported winds of 50 knots or more.

There were five deaths associated with Charley and damage was estimated to be $15 million.

Tropical Storm Danielle

SEPTEMBER 7-10

Danielle can be traced to disturbance that moved off the African coast on September 1st. During the 6 and 7th satellite pictures showed that the system had acquired a low-level circulation and was approaching the Lesser Antilles. Wind speeds were estimated to have reached storm strength on the afternoon of the 7th, based on satellite intensity estimates.

The storm moved through the Windward Islands on the 8th causing some damage, primarily to crops, on St. Vincent and the Grenadine Islands. Danielle continued into the central Caribbean, where the low-level circulation separated from the deep convective clouds that are required to maintain the strength of tropical cyclones (fig. 6). By the 10th, the system had completely lost its circulation.

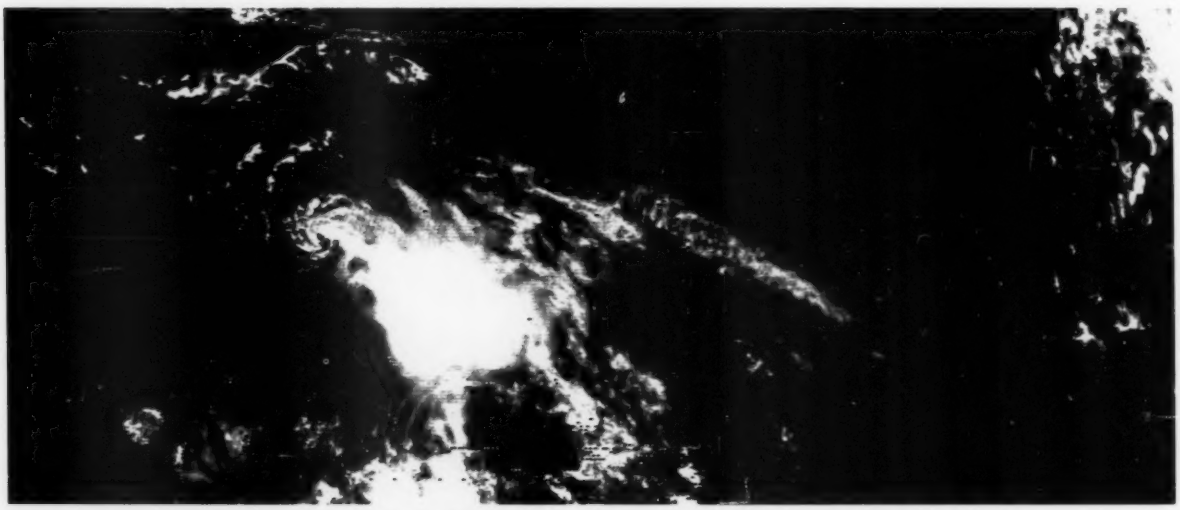


Figure 6. -- Danielle on the 9th, over the eastern Caribbean, showing sea-level circulation after separation from convection. NOAA GOES.

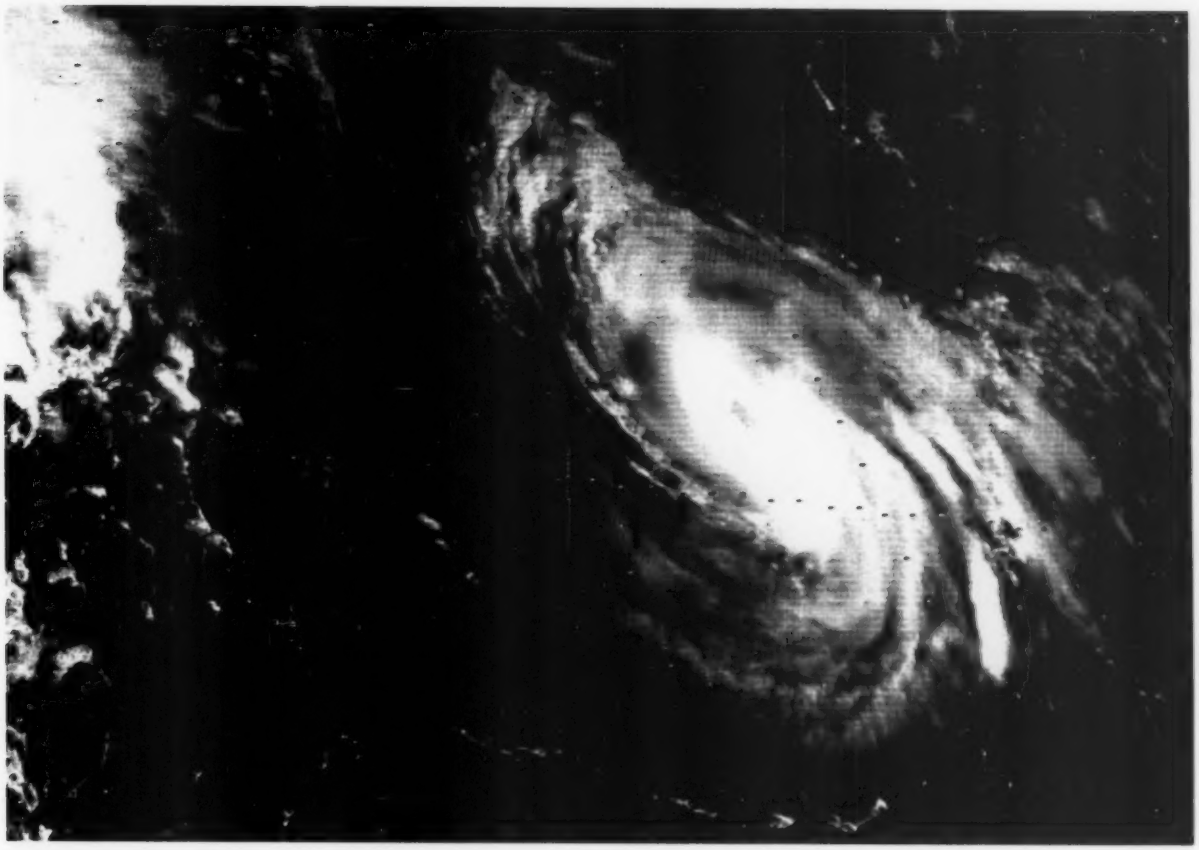


Figure 7. -- Earl at its peak on the 14th over the mid Atalntic. NOAA GOES

Aircraft reconnaissance indicated that the strongest winds of 50 knots occurred on the 8th, while the storm was passing through the Winward Islands.

Hurricane Earl

SEPTEMBER 10-18

A tropical weather disturbance moved off the Afriican coast on September 4th, following Danielle's origin by a few days and located several hundred miles farther north. The system gradually turned northwestward and, on the 9th, interacted with an upper-level circulation. This resulted in the formation of a surface depression on the 10th, centered about 1000 miles east of Puerto Rico.

The depression quickly strengthened, and by the time the reconnaissance plane reached the area late on the 11th, 1500 foot flight level winds were 75 knots, well above the 64-knot hurricane threshhold. On the next day, a plane found a broad area of 85-knot winds with a peak wind of 90 knots. From the 12th through the 15th Earl's northward motion was blocked and the hurricane drifted eastward (fig. 7). On the 16th, a northward motion was resumed and Earl headed into the major shipping lanes where it gradually became extratropical.

Earl was a hurricane for seven days and was the longest-lasting, as well as the most intense, hurricane of the season. Several ships encountered winds of 50 knots or more, mainly

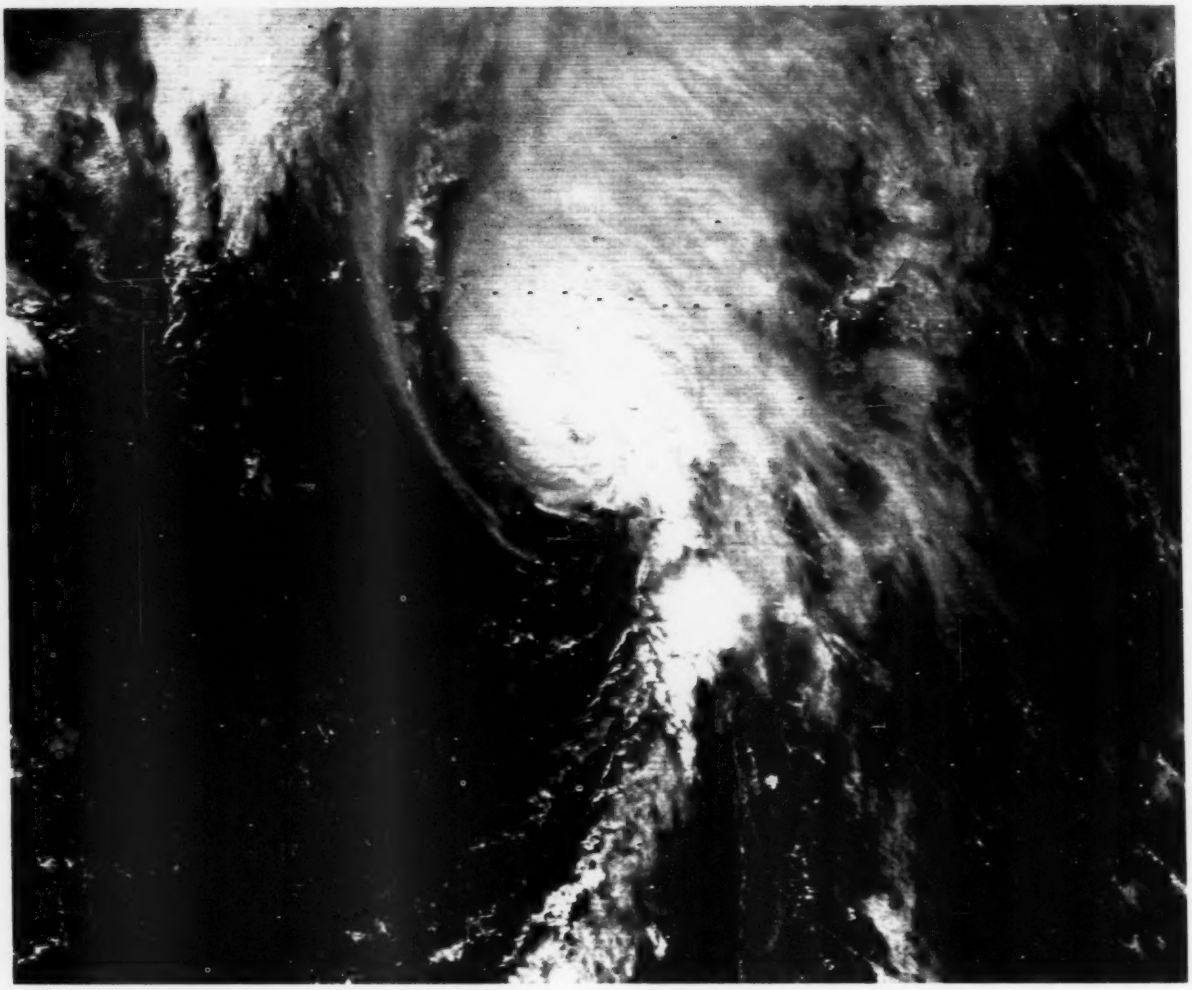


Figure 8. -- Frances on the 20th about 400 miles southeast of Bermuda. NOAA GOES.

during the period Earl was becoming extratropical in the far North Atlantic.

Hurricane Frances

NOVEMBER 18-21

The last named tropical cyclone of the year was Frances, a late November hurricane that, like Earl, remained at sea.

The origin of Frances was first seen on satellite pictures on the 15th as an area of cloudiness northeast of the Lesser Antilles. On the 17th, a circulation was detected and, by the 19th, the ship VLADIR ILYICH (UQJX) reported 35-knots winds and heavy rain near 23.2°N 61.2°W, indicating that the system was of tropical storm strength.

On the 20th, a plane found 75-knot winds and a surface pressure of 1000 millibars or 29.53 inches and this was the basis for upgrading Frances to a hurricane when it was centered some 400 miles southeast of Bermuda (fig. 8). Frances accelerated toward the northeast and dissipated on the 21st as it merged with an extratropical low pressure system.

marine observation program

--by Martin S. Baron
National Weather Service
Silver Spring, Md.

Weather Report Costs

The U.S. National Weather Service (NWS) pays the transmission cost for ships' weather observations from shaded areas in figure 1, including the Great Lakes. In the Atlantic Ocean this covers all areas west of 35°W and north of 3°N, including the Carribean Sea and Gulf of Mexico. In the Pacific Ocean, all areas east of 160°E and north of 25°S, including the Gulf of Alaska and Bering Sea, are covered. Also included are weather reports from two other areas -- one near Guam between 5°N and 25°N and from 135°E to 160°E and the other south of 60°S (waters near Antarctica). The NWS has the responsibility to prepare weather forecasts and storm warning for these areas, and ships' weather reports provide the basic data needed for this purpose. The NWS asks all deck officers to include observed sea and swell data in their weather messages -- period of the sea waves, primary and secondary swell in seconds (code figures P_wP_w, $P_{w1}P_{w1}$, $P_{w2}P_{w2}$), true direction from which the swell waves are coming ($d_{w1}d_{w1}$, $d_{w2}d_{w2}$), and the height of the sea and swell (H_wH_w, $H_{w1}H_{w1}$, $H_{w2}H_{w2}$). There is a paucity of sea and swell data from all areas.

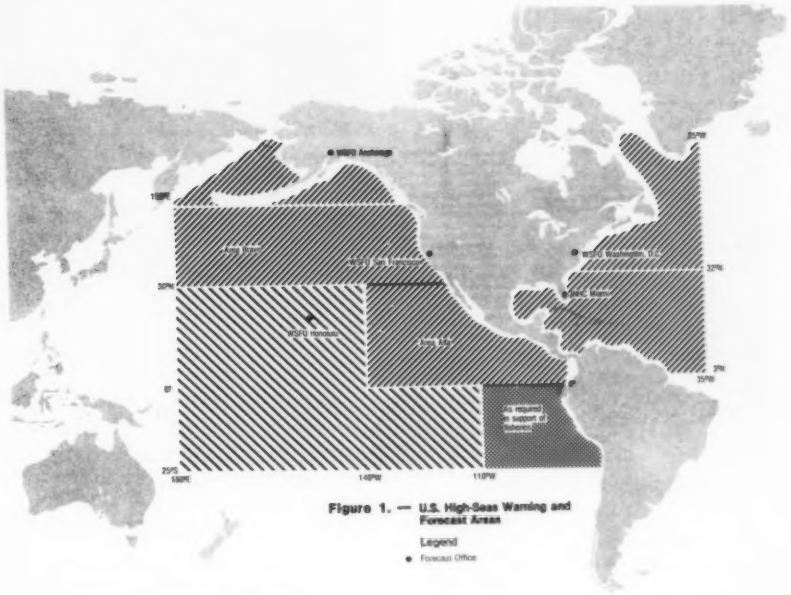


Figure 1. — U.S. High-Seas Warning and Forecast Areas

This payment policy is for all ships' weather reports, including special reports (designated with prefix SPREP at the front of the weather message before the call sign), and

3-hourly reports from near tropical storms or from within coastal waters. It applies 24 hours a day, 7 days a week. Any vessels billed for weather reports from the designated areas should report this to the Marine Observations Program Office, so that corrective action can be taken.

The preferred method of relaying ships' weather reports is through U.S. Coast Guard radio stations. These reports are relayed by the Coast Guard free of charge to the NWS. Vessels using INMARSAT as their main communications system are encouraged to relay weather messages with it. Vessels should use commercial shore relay stations only if Coast Guard stations or INMARSAT are not available.

Award for Soileau

The Marine Observations Program staff and Port Meteorological Officers have presented an award to Julius Soileau, PMO in Houston. Julius, injured during a routine ship visit last June, has recovered in a remarkable fashion that has been a real example of courage and a strong positive outlook. Julius was presented with a tide clock and plaque which reads, "Julius Soileau, National Weather Service Port Meteorological Officer, Gulf of Mexico, 1966-1986. In recognition for superior service from your fellow PMO's, 15 November 1986." See figure 2.

Figure 2. -- Julius with his award is flanked by his wife Irene and MIC Steve Harned.

Supplies for Observers

The NWS provides free-of-charge all the instructions, supplies and equipment vessels need to take weather observations. NWS Observing Handbook #1 explains the overall program and provides detailed explanations of the elements of the Ships' Synoptic Code. The Ships' Code Card is a 4-page guide providing abbreviated explanations of the Code. NOAA Form B-81, Ship's Weather Observations, has precoded columns for the observer to write down the weather observation. The coded weather report is copied onto NOAA Form B-80, Weather Report for Immediate Transmission, and then given to the Radio Officer for transmission to the NWS. Weather map bases for the Atlantic and Pacific Oceans, "Pilot Charts," the "Notice to Mariners," and the "Mariner's Weather Log" are all available. "Radio Stations Accepting Ships' Weather and Oceanographic Reports" explains how and where to transmit the observations worldwide. Envelopes preaddressed to your Port Meteorological Officer, are available to mail in your completed "Ship's Weather Observations" sheets. The booklet, "Worldwide Marine Weather Broadcasts," lists radio stations and the times of the meteorological products they broadcast. Dedicated vessels enrolled in the NWS Voluntary Observing Ship Program can receive barometers, barographs (with barograms), sling psychrometers, and sea-water bucket thermometers. Before leaving port, make sure you have all the weather observing and reporting supplies you need. Contact the nearest PMO for assistance. A list of PMO's and their locations appears inside the back cover of this publication. Supplies can be delivered to you on short notice, using next-day delivery services.

tips to the radio officer

--by Jullie L. Houston
National Weather Service
Silver Spring, Md.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (January 1985 Edition)

PAGE: 1
REPLACE: (W/OTS32) with (W/OSO151) Room 419

PAGE: 59
ADD: WSC, West Creek, New Jersey
WKM, New Haven, Connecticut

PAGE: 68
ADD:
TIME: 1218
PRODUCT: W,F
AREA: North Atlantic West of 35`W including the Caribbean Sea and Gulf of Mexico.
FREQUENCY: 482, 4316, 6484.5, 8680, 12879.5, 16916.5 and 22418
SOURCE: WSC, West Creek, NJ, USA

ADD:
TIME: 1300
PRODUCT: W,F
AREA: North Atlantic West of 35`W including the Caribbean Sea and Gulf of Mexico.
FREQUENCY: 442, 8534, 12948 and 16978
SOURCE: WKM, New Haven, CT, USA

PAGE: 186
DELETE: WBR, Miami, Florida

PAGE: 190 - 191
DELETE: All entries for WBR, Miami, Florida, USA

PAGE: 190
ADD:
TIME: 0530
PRODUCT: W,F
AREA: Southwest North Atlantic, Caribbean Sea, Gulf of Mexico, West Central North Atlantic, Pacific Alfa and Bravo.
FREQUENCY: 4352, 8707, 13083.5, 17199.5 and 22588
SOURCE: WLO, Mobile, AL, USA
NOTE: 3

the mail bag

"Three Sisters" Comments

Dr. Laurence Draper noted physicist and wave expert from the Institute of Oceanographic Sciences in England recently wrote Jerry Nickerson and myself concerning the "Three Sisters" article, which appeared in the last issue of the Log. Dr. Draper brought out several pertinent points about the feasability of reporting freak waves. His inquiry has prompted the following revision by Jerry:

In the "Three Sisters" Mar Historic Voyage" story in the Fall 1986 edition of the Mariners Weather Log, there is box on page 191 entitled "Reporting Freak Waves". On line 6 and 7 in that box, please replace World meteorological Organization (WMO) with International Maritime Organization (IMO).

The IMO has put out a book of regulations called the "International Convention for the Safety of Life at Sea (SOLAS), 1974." In Chapter V, Safety of Navigation (page 184), Regulation 2, Danger Messages it says: "(a) the master of every ship which meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, ..., is bound to communicate the information by all the means at his disposal to ships in the vicinity, ..." There is an existing requirement to report freak waves, for freak waves certainly are a direct danger to navigation. The recommendation in the box is that the words, " freak waves" be added to the regulation after dangerous ice. Mariners generally follow regulations if they are specific on how they should comply.

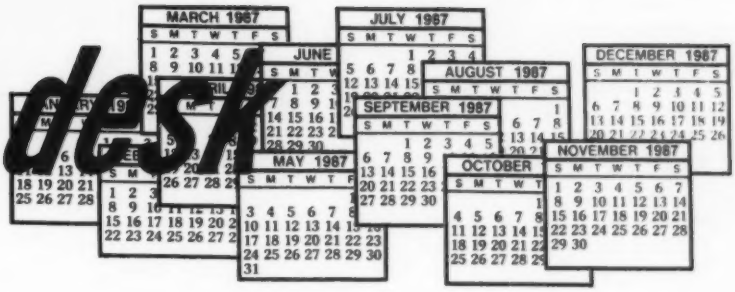
Where is She Now ?

A note from Capt. James Drahos dated Jan. 22, 1987 was helpful in answering the ever popular question. Thanks for the following information:

"As of a week ago and for the last 4 months, at least, the MANHATTAN has been idle in Portland, OR. Previously, she had been carrying North Slope crude to the Lower 48, but I don't know if she is now idle due to economics or awaiting sale, scrapping or what.

"Her original bow replaced at Sun Ship before the Northwest Passage trip, laid at Chester yard for a number of years before being scrapped."

the editor's desk



Editor's Note

This is the beginning of our 31st year. The Mariners Weather Log has achieved a good reputation, within the maritime community, thanks to past editors such as Hans Rosendal, Pat Hughes, Rich Schwerdt and Earl Wilson under the leadership of Art Cooperman. All were dedicated to the principle that the Log is a return on the invaluable observations from the mariners. Along the way we have picked up several other audiences interested in weather at sea.

I have been associated with the Log for 20 years and hope to continue the tradition. While I do have some ideas, the intent will remain the same. Criticism and suggestions are welcome, as are articles and photographs. We are hoping to establish a column for and about the Port Meteorological Officers (PMO's), who are the backbone of the Voluntary Observing Ship program. We also hope to expand the coverage of weather over the oceans.

My major objective is to keep the magazine informative and see the day my wife picks it up and reads it--voluntarily.

Coast Guard Rescue

Sometimes we take the Coast Guard for granted. It is usually during bad weather at sea when their competence comes to the fore. Usually there are no witnesses. The following incident was witnessed as this letter from William H. Lazar, which appeared in the Evaston Review on September 18, 1986, indicates.

This letter is in appreciation of the good work by the Coast Guard Station at Wilmette Harbor. There are many factors that make our property values high and life style so good here, and Lake Michigan has to rank high on the list for its beauty and recreation. Having a Coast Guard lifeboat station so close is a privilege that adds a real measure of safety for those who use the lake.

We witnessed this help in action the evening of Sept. 10, when a Coast Guard team assisted a boater in difficulty. Two kayaks were in rough seas a quarter-mile off the lighthouse when one capsized. The boater was unable to get back aboard even with the help of his friend. They were

also unable to paddle to shore against the wind and were being driven out into the lake. With dusk coming on it was clearly a dangerous situation. Within minutes of a call to Station Wilmette a rescue boat was on the scene. The man was pulled from the water, allowed to rest and warm up for a few minutes, then both boats were safely escorted to shore.

The men at Station Wilmette are skilled at what they do and devoted to our safety. They deserve our cooperation and our thanks.

NASA Radiometer

An airborne sensing device that could greatly enhance satellites'capability to monitor ocean weather patterns has been developed by researchers at NASA'S Jet Propulsion Laboratory (JPL), Pasadena, Calif.

The new infrared radiometer, used to measure ocean surface temperatures, is 100 times more sensitive than typical radiometers. The new radiometer's ability to distinguish between the temperature of the ocean surface and that of the atmosphere immediately above is considered a major scientific advance. Earlier airborne sensors lacked this ability, making the task of assembling highly accurate climate maps more problematic.

The infrared radiometer aboard the Columbia is tested against the buoy below in San Pedro harbor. NASA

The radiometer was tested in flights over waters between Los Angeles and Southern California's Santa Catalina Island, aboard the Goodyear blimp Columbia.

Researchers hope that temperature and wind maps generated by such instruments will help scientists develop better models of highly complex global weather interactions -- for example, how storm systems are generated in the tropics and spread to other latitudes.

hurricane alley

hurricane alley

North Indian Ocean Tropical Cyclones, 1985

Joint Typhoon Warning Center Staff

Tropical cyclone activity in the North Indian Ocean was above normal. Six significant tropical cyclones, all of tropical storm intensity, developed as compared to the climatological mean of four (table 1). These systems occurred in the spring and fall transition season, which normally encompasses the peak of the activity (fig. 1 and table 2). The following is a brief summary of the more intense systems.

Table 1. — 1985 Tropical Cyclone Summary

NORTH INDIAN OCEAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1985 TROPICAL CYCLONES	0	0	0	0	2	0	0	0	0	2	1	1	6
1975 - 1985 AVERAGE	.1	-	-	.1	.8	.4	-	.1	.3	1.1	1.4	.4	4.5
CASES	1	-	-	1	9	4	-	1	3	12	15	4	50

Tropical Cyclone 01B

Although only reaching an intensity of 60 kn, it was one of the most noteworthy storms of 1985 due to the tremendous loss of life the cyclone caused in Bangladesh. An estimated 6,000 people died from the storm, with an additional 300,000 people left homeless. Most of the deaths were due to the storm surge, estimated at 15 ft (5 m), which completely inundated many of the low-lying islands (fig. 2).

In several cases the only structures left standing were concrete multi-story shelters built after the 1970 cyclone. The islands of Sandwip, Urir Char and Bhola were among the most heavily damaged.

Tropical Cyclone 04B

It was first detected on 9 October, almost a week before the initial warning was issued.

During the 13th and 14th, the disturbance turned to the northwest, crossed the northern Andaman Sea and entered the Bay of Bengal. By 1200 on the 15th, synoptic data from ships located a

Table 2. — 1985 Significant Tropical Cyclones

TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WIND KT - (M/S)	ESTIMATED MSLP MB	BEST TRACK DISTANCE TRAVELED NM - (KM)
TC 01B	23MAY - 25MAY	3	8	60 (31)	979	515 (954)
TC 02A	29MAY - 31MAY	3	12	50 (26)	987	609 (1128)
TC 03B	9OCT - 11OCT	3	7	50 (26)	988	667 (1235)
TC 04B	15OCT - 16OCT	2	4	50 (26)	987	296 (548)
TC 05B	15NOV - 18NOV	4	12	55 (28)	983	843 (1561)
TC 06B	11DEC - 14DEC	4	11	50 (26)	987	1025 (1898)
	1985 TOTALS:	19	54			

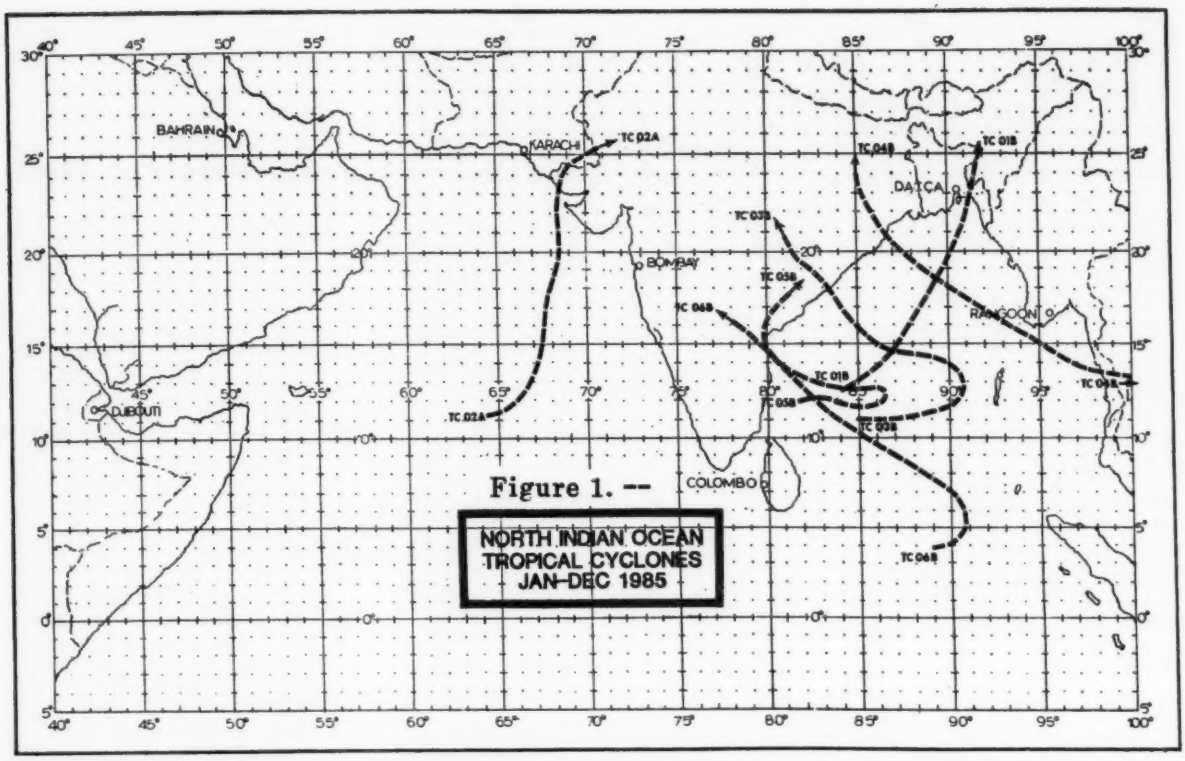


Figure 1. --

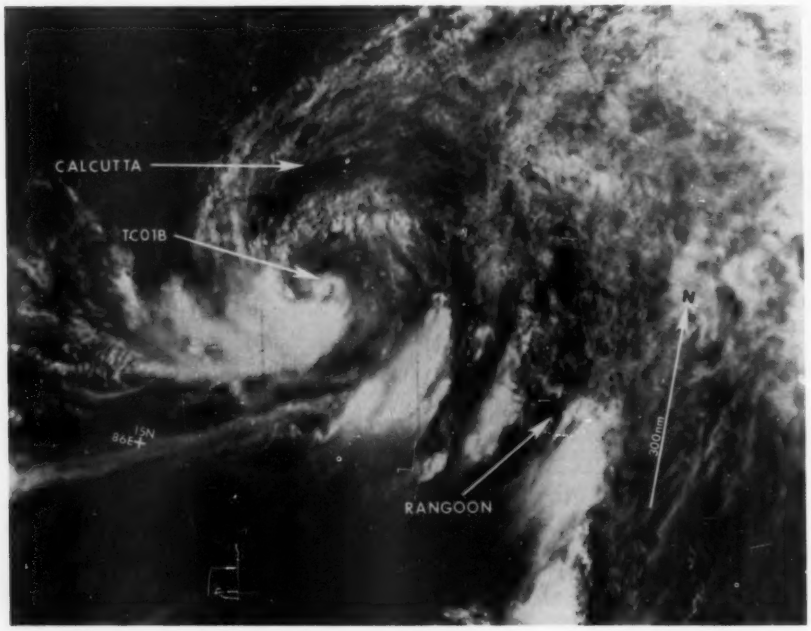


Figure 2. -- Tropical Cyclone 01B, on the 24th, less than 1 day prior to landfall over Bangladesh.

rapidly developing cyclone about 180 mi south of Calcutta. Minimum sea-level pressure was estimated to be near 990 mb and winds had increased to 45 kn. Subsequent ship reports had indicated a continued fall in pressure and confirmed surface winds of 45 kn.

By 0000 on the 16th, Tropical Cyclone 04B had reached maximum intensity as it made landfall on the coast of India approximately 55 mi south of Balasore. A large area of strong convection remained associated with the system (fig. 3).

At least 38 people were killed, with over 200 reported still missing as late as 6

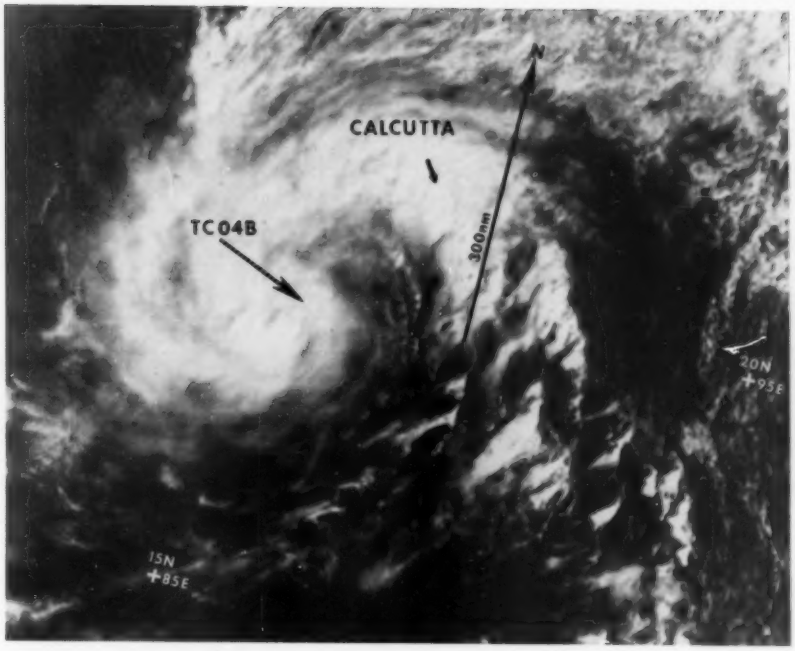


Figure 3. -- Tropical Cyclone 04B, on the 16th, just after landfall over eastern India.

days after the storm struck the coast. Most of the missing were from the east Indian state of Orissa where a village was completely washed away by flood waters. Heavy rain-induced flooding combined with storm-induced high tides to swamp offshore islands cutting off access to more than 500 villages.

Tropical Cyclone 05B

Tropical Cyclone 05B formed as a monsoon depression 120 mi east southeast of Madras, India. Tropical Cyclone 05B finally began to intensify slightly when it reached the eastern extent of the monsoon trough at about 0000 on the 15th. Tropical Cyclone 05B reached a maximum intensity of 55 kn just prior to landfall 0600 on the 17th, 90 mi north of Madras. No reports of damage or loss of life were received.

HURRICANE WATCH, 1986

Jan.

Aust. - S. Pac.

8S	T
Hector	T
Pancho	T
Vernon	T
Winifred	H

S.Ind.

Delifinina	H
Costa	H
06S	T
Ophelia	H
Erinesta	H

N.Ind.

01B	T

Feb.

Aust. - S. Pac.

Ima	H
June	T
Keli	T
Tiffany	T

S.Ind.

Filomena	T
Rhonda	T
Gista	H
Selwyn	T

W.N.Pac.

Judy	H

Mar.

Aust. - S.Pac.

Victor	H
Lusi	T
Alfred	T

S Ind.

Homorinina	H
Iarima	T
Jefrotra	H

Apr.

Aust. S. Pac.

Martin	H
30P	T
Manu	H

S.Ind.

Alison	H

W.N.Pac.

Ken	H

May

Aust. W.N. Pac.

Manu	H
	T
	H

S.Ind.

Billy	H

W.N.Pac

Lola	H
Mac	T

E.N.Pac.

Agatha	H

June

W.N. Pac.

Nancy	H
Owen	T

E.N.Pac.

Bias	T
Celia	H
Frank	H

N.Atlc.

Andrew	T
Bonnie	H

July

W.N.Pac.

Peggy	H
Roger	H
Sarah	T

E.N.Pac.

Darby	T
Estelle	H
Frank	H

Aug.

W.N. - Pac

Tip	H
Vera	H
Wayne	H

E.N. Pac.

Georgette	T
Howard	T
Isis	T
Javier	H
Kay	T

N.Atlc.

Charley	H

S. Ind.

34S	T

Sept.

W.N. Pac.

Abby	T
Ben	H

E.N. Pac.

Lester	T
Madeline	T
Newton	H
Orlene	H
Paine	H

N.Atlc.

Danielle	T
Earl	H

Oct.

W.N. Pac.

Carmen	H
Dom	T
Ellen	H
Forrest	H
Georgia	T

E.N. Pac.

Roslyn	H

Nov.

W.N. Pac

Herbert	T
Ida	T
Joe	H
Kim	H

N. Atlc

Frances	H

N. Ind.

3A	T

S. Pac.

2P	T

Dec.

N. Ind.

6B	T

S. Pac.

2S	H
3P	T

MARINE WEATHER REVIEW

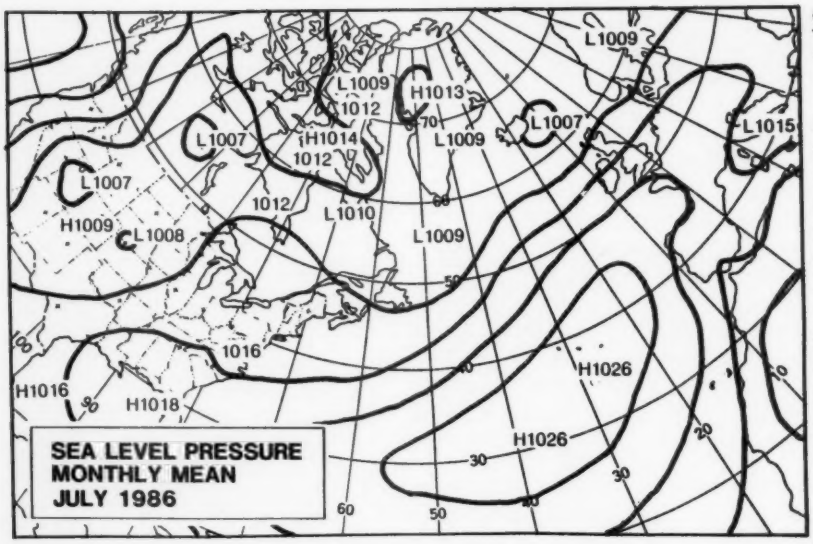


Figure 1. -- The midsummer weather scene.

July 1986 -- If the living is easy in summertime, this month's weather pattern reflected that for the most part (fig. 1). The large Bermuda - Azores High stretched over most of the Atlantic and was just slightly stronger than normal -- up to 3 mb stronger in the Bahamas. The cyclonic activity was indicated by a -3 mb anomaly from off New England to Greenland. This activity was also apparent in the upper atmosphere; the 700 mb level showed a trough near the Grand Banks and an east northeasterly gradient north of the upper level version of the Bermuda - Azores High.

On this Date

— July 13, 1986 —

The research vessel Atlantis II arrived at the site of the TITANIC, about 350 mi southeast of Newfoundland. The weather was excellent and the vessel was located with little problem. Several LOWs moved through the area but did not affect the dives that took place over the next 11 days (fig. 2).

Extratropical Cyclones

— While strong low pressure systems were few and far between, there was no lack of weak LOW's this month. Most of this activity stretched from Nova Scotia to Norway, with some off the northeast U.S. coast and some off England.

A local system in the Mediterranean Sea was responsible for thunderstorms, which triggered a devastating

"Just when you thought it was safe to go back to sea"

The Monster is Back

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and mean pressure patterns provide a definitive report on the primary storms that affected the North Atlantic and North Pacific Oceans. The monster of the month is a title given to an extratropical system that may have been particularly dangerous. Unless otherwise stated, all winds are sustained and not gusts; all times are G.M.T.

North Atlantic Weather Log

July, August, and September

Figure 2. -- Two bollards used to secure mooring lines, and a railing on the starboard side of the TITANIC's bow are visible. Remotely operated cameras were deployed from the manned submersible ALVIN after a 2½-hr descent to the bottom of the North Atlantic. *Courtesy of Woods Hole Oceanographic Institution.*

landslide at Senise, Italy. On the 26th, before dawn, a sandy hillside collapsed into a narrow valley crushing several villas and killing at least 8 people. The area is some 20 mi northwest of the Gulf of Taranto.

This storm originated on the 1st over the central U.S. Along with its frontal system, it swept off the East Coast the following day. While the central pressure only dropped to 992 mb, the system triggered some gales and even a few storm force winds, mainly between 40°N and 50°N on the 3d and 4th. At 1200 on the 3d the H049 near the storm's center reported a northeast 50-kn wind. During the day several vessels, including the ROWAN GORILLA I and the BEN HOPE, encountered gales; the latter reported 16-ft swells. The system was heading east northeastward. By the 4th pressure near the center was up to 1003 mb.

A weak stationary front over southern Virginia spawned this LOW on the 17th. After meandering eastward for a few days it turned northward on the 19th. By the 20th this storm was off the coast of Nova Scotia. On the 19th, at 1200, the SHIRLEY LYKES (31°N, 64°W) encountered 35-kn winds in 8-ft swells while the ATLANTIC AMITY (40°N, 57°W) ran into 35-kn east southeasterlies in 13-ft swells. Winds of 40 kn were reported 6 hr later by the TFL EXPRESS, near 41°N, 57°W, as she battled 23-ft swells. Gales continued through the 20th. Maximum reported winds ran about 40 kn. These conditions continued the following day as the system headed toward Greenland. The VSBC reported a southerly wind at 43 kn near 47°N, 48°W early on the 21st. The SEDCO 710 confirmed this by recording winds in the 37- to 41-kn range throughout the day. The VSBC had a reading of 46 kn at 1200. These two rigs did an excellent job of defining this summer storm. By the 22d it had moved across Kap Farvel and was weakening as it headed for Iceland.

This system came to life on the 25th along the 40th merdian just north of 50°N. Heading northeastward, then eastward, the storm intensified as central pressure dropped to 986 mb on the 26th. Gale reports came in from such vessels as the AQUABA CROWN, DAVID PACKARD, HELEN and the VIGILANT. Winds were running 35 to 45 kn while seas up to 16 ft were reported. On the 27th, at 0600, the ISLE OF ARRAN, near 56°N, 5°W, hit 45-kn south southwesterlies. By this time the system was beginning to fill as it turned northward through the Norwegian Sea.

Tropical Cyclones --

July averages about three tropical cyclones every four years. Last year saw two tropical cyclones, including one hurricane, form in July. This year there was none.

Casualties --

The Dutch Navy rescued crewmen from a vessel which began to sink off the Dutch coast after loose cargo shifted on the 7th. The crew was taken onboard the PIETER FLORISZ. No one was injured in the incident, which occurred in high winds 15 mi off Den Helder. The BEECHGLEN ran aground in heavy fog on the 20th on a voyage from Thunder Bay for Three Rivers; the incident took place southwest of Valleyfield in Lake St. Francis. She was freed by tugs the following day. A search for two crewmen from the yacht BERLUCCHI CHAMPENOIS D'ITALIA was unsuccessful. The vessel was reported missing on the 14th, while taking part in a transatlantic yacht race.

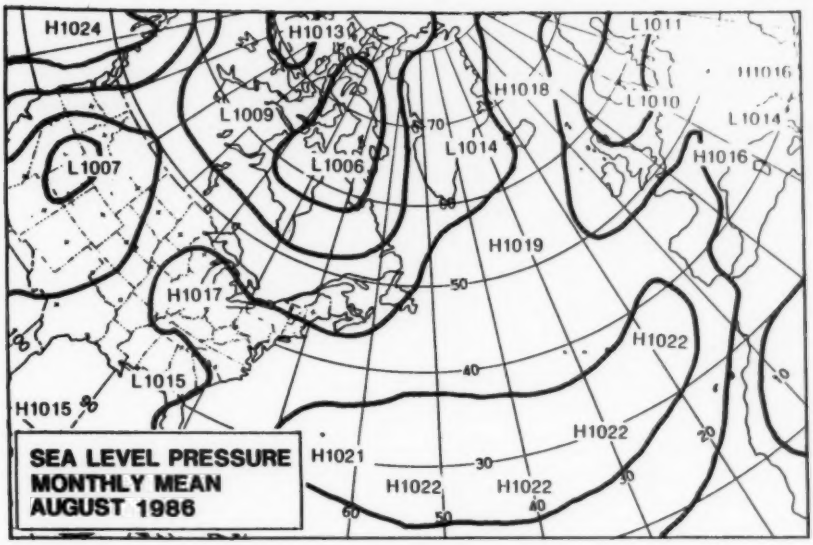


Figure 3. -- A misleading picture.

August 1986 -- A quick glance at the mean pressure chart (fig. 3) would lead you to believe that the month was typical of summer with England possibly enjoying a little better than normal weather. Averages do lie occasionally. Mean pressures north of 50°N were up as much as 8 mb, while the extent of the Azores - Bermuda High was not as far north as normal. These seem to be contradictory statements, but between these two anomalies lies the truth. The Azores-Bermuda High and relatively high pressure over the northern North Atlantic - Norwegian Sea area created a channel from Nova Scotia to the British Isles. Storms, like water, often follow the path of least resistance and this channel provided that path. So England instead of basking in the summer sun was beseiged by a series of low pressure systems, some weak and some strong, throughout the month. This channel was also reflected at the 700-mb level where the only significant gradient was nearly zonal, between 40°N and 60°N.

On this date

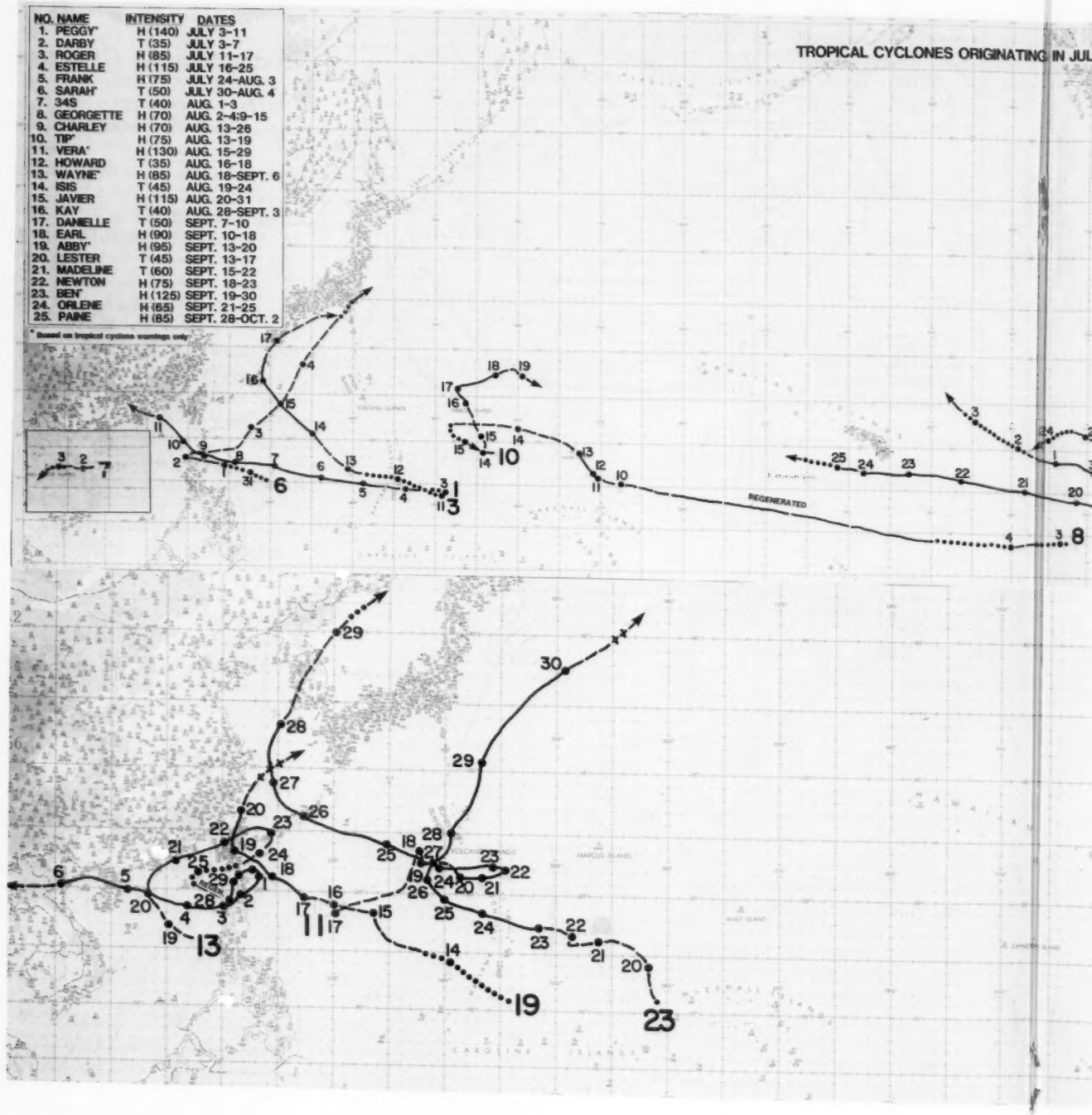
— August 6, 1843 —

A spectacular cloudburst near Philadelphia turned small creeks and streams entering the Delaware River into raging torrents. As much as 16 in of rain fell in just 3 hr. Flooding caused 19 deaths and destroyed 32 bridges. It is believed that several small tornadoes accompanied the downpour, one of which upset and sunk more than 30 barges on the Schuylkill River.

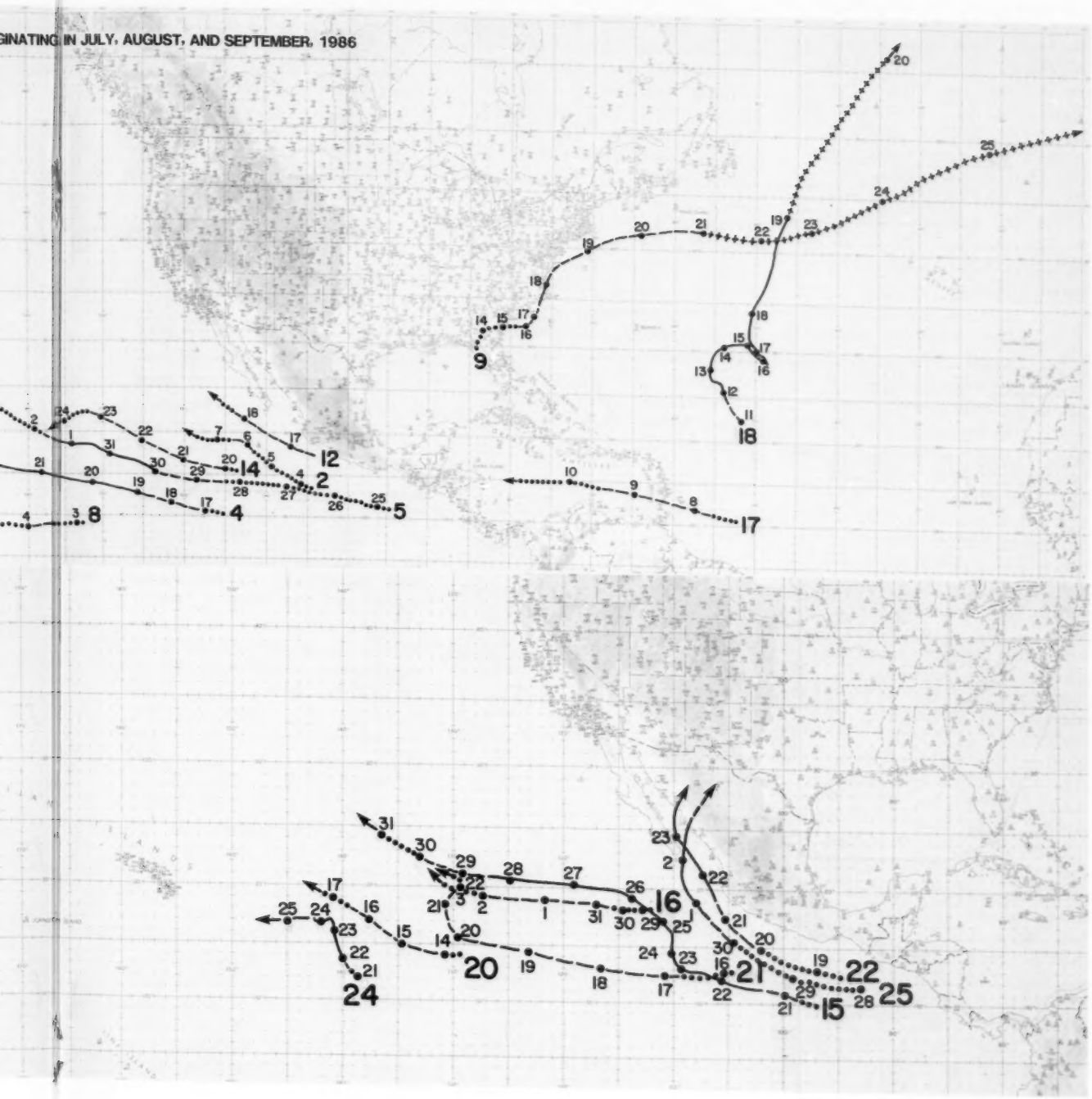
Extratropical Cyclones

-- This was not a month to be sailing around, or vacationing in, the British Isles. The month opened and closed with severe weather in this area. In between things were not too much better. It was a month of extremes. The country saw the worst August weather for nearly half a century and tail-end of hurricane Charley finished a dreary month. At the Askham Bryon Agricultural College, York, 4.38 in of rain was recorded with average of 3.9 hr of sunshine per day. This contrasts with August 1983 when 1.2 in fell and sunshine averaged 6.5 hr daily. While much of Britain and some of France was under water a drought plagued the southeast U.S. In fact it was so bad that barge shipping was halted on the Chattahoochee, Flint and Apalachicola Rivers, due to low water. South of Bainbridge the water level was 4.5 ft below the 9-ft optimum depth for barges.

Charley created problems from the Gulf of Mexico to the North Sea, and it was its extratropical stage that made it monster of the month. In France it was preceded by a local storm which


TROPICAL CYCLONES ORIGINATING IN JUL
NO. NAME INTENSITY DATES
1. PEGGY* H (140) JULY 3-11
2. DARBY T (35) JULY 3-7
3. ROGER H (85) JULY 11-17
4. ESTELLE H (115) JULY 16-25
5. FRANK H (75) JULY 24-AUG. 3
6. SARAH* T (50) JULY 30-AUG. 4
7. 34S T (40) AUG. 1-3
8. GEORGETTE H (70) AUG. 2-4;9-15
9. CHARLEY H (70) AUG. 13-26
10. TIP* H (75) AUG. 13-19
11. VERA* H (130) AUG. 15-29
12. HOWARD T (35) AUG. 16-18
13. WAYNE* H (85) AUG. 18-SEPT. 6
14. ISIS T (45) AUG. 19-24
15. JAVIER H (115) AUG. 20-31
16. KAY T (40) AUG. 28-SEPT. 3
17. DANIELLE T (50) SEPT. 7-10
18. EARL H (90) SEPT. 10-18
19. ABBY* H (95) SEPT. 13-20
20. LESTER T (45) SEPT. 13-17
21. MADELINE T (60) SEPT. 15-22
22. NEWTON H (75) SEPT. 18-23
23. BEN* H (125) SEPT. 19-30
24. ORLENE H (65) SEPT. 21-25
25. PAINE H (85) SEPT. 28-OCT. 2
* Based on tropical cyclone warnings only
REGENERATED

GINATING IN JULY, AUGUST, AND SEPTEMBER, 1986



helped put out several forest fires as well as putting parts of Marseilles under several feet of water. In Milan on the 18th a "whirlwind" accompanied by hailstones left a trail of destruction. On the outskirts of Milan hailstones the size of apples formed a thick carpet on the road, hampering rescue operations.

This short-lived storm had its beginnings late in July but was most devastating in the first part of August It developed rapidly to the southwest of Ireland on the 1st. It crossed into Ireland that same evening and by the 2d was headed into the Norwegian Sea. The fast moving, intense storm played havoc with weather throughout the British Isles. A trawler, the CONTESSA VIV was caught in gale force winds, which gusted to storm strength at times, and was grounded on the rocks and then sank at the western approach to Bear Haven harbor. Ten crewmen, including the skipper, were rescued, however five Spanish seamen drowned. Some of the worst weather occurred in Dublin Bay where winds reached 50 kn. In Dun Laoghaire a Galway hooker and a catamaran broke free of their moorings and caused considerable damage.

Out of a messy situation this LOW came to life southeast of Iceland on the 3d. It moved southward until reaching the 50th parallel on the 5th, when it turned northeastward (fig. 4). By the 7th it was over Scotland and generating gales in the North Sea. In fact on the 8th at 1800, two ships reported winds in the 60-kn range. However the system was up against the rugged Norwegian terrain by this time and beating itself out.

This storm began inconspicuously as a small Low off southeastern Greenland on the 7th. After meandering in the Denmark St for a few days, it finally got its act together and headed southward on the 12th. This track was reminiscent of the previous storm's path just one week earlier. On the 12th the DE HOOP (57°N, 8°E) encountered 60-kn northerlies; this might seem like an exaggeration except that the MATNAS TEZEN came in with a 56-kn northeasterly near 60°N, 2°W. After swinging south of 55°N the storm turned northeastward and headed for Scotland and Wales. Gales continued to be reported in the eastern semicircle. At 1200 on the 13th the PROTEKTOR near 56°N, 21°W encountered

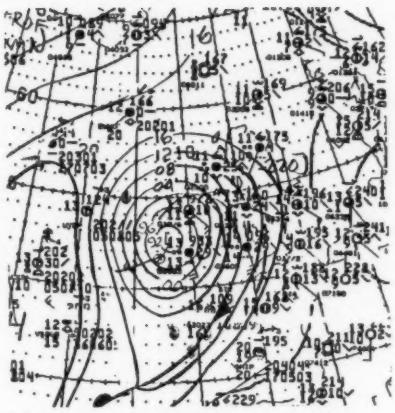


Figure 4. -- 990-mb storm nearing Great Britain at 0600 on the 6th.

44-kn northwesterlies in 15-ft swells with a 9-sec period; this translates into a slope of 1/25, approximately, which is on the steep side. On the 14th the CMB EUROPE and the KAPITAN KOZLOVSKY both reported gales as did the PIONIER MOURMANA. On the 15th the CELTIC ENDEAVOUR near 53°N, 5°W hit south southwesterly winds at 44 kn in 23-ft seas that had a slope of about 1/20. In general winds in the North Sea and off south Norway were running 35 to 40 kn. The system moved across Norway on the 17th and into Finland the following day. Ships and drilling rigs continued to report gale and a few storm force winds through the 16th and into the 17th.

On the 16th, while tropical storm Charley was buffetting the South Carolina coast, a LOW was forming some 1400 mi to the northeast. Moving in a general east northeasterly direc-

tion the system was trailed by the tropical cyclone, which remained about three days behind. On the 20th the LOW's 980-mb pressure center crossed 50°N near 25°W. Gale force winds were being encountered to the south of the center, along a cold front. Seas were running 13 to 15ft. On the 22d the weakening system moved across Ireland.

Monster of the Month -- On the 20th Charley was beginning to turn extratropical thus becoming eligible to be our monster. Moving on a path similar to the previous storm, Charley became a potent storm to shipping during the last 10 days of the month. The ROWAN GORILLA I tracked the storm for a couple of days and sent in some valuable observations. For example on the 20th at 1200 she reported northeast 66-kn winds near 44°N, 60°W. The VSG8 encountered 55-kn northeasterlies near 44°N, 58°W at the same time. By the 22d central pressure was down to 984 mb and the monster Charley was heading toward England. Gale reports continued to flood the airways.

Actually on the 24th it looked like Charley was going to end it all. He came back to life with a bang. From a 998-mb wimp early on the 25th, Charley turned into 985-mb bull by the 27th, terrorizing the North Sea and surrounding land masses. At 0000 on the 27th the JENS KOFOED in the southern Baltic was reporting 72-kn winds from the east southeast, while observations from the oil fields were running 35 to 50 kn. The KIRKELLA in the North Sea, off Flamborough Head, encountered northwest winds at 50 kn in 20-ft swells with a wave slope of about 1/10 -- an indication they were near to breaking. At 1200 some 20 gale reports were received. Relief finally came on the 28th as the storm began to fill. The remnants of Charley were considered one of the worst storms of the century in Ireland. Its cost will run into the tens of millions of pounds when flooded property, ruined crops and other damage is taken into account. In Castlekelly, county of Dublin, nearly 8 in. of rain was recorded in 24 hr. All along the east coast damage was caused to yachts and fishing vessels in harbors. There was severe flooding along the seafront in Bray and in the Dublin area, trees were blown down severely disrupting traffic. The River Mulclair burst its banks and 30 thousand acres of land were reported to be under water. In England and Ireland at least 11 people were killed and torrential rain driven by gales swept the country from the south coast to the Scottish border. Ireland took the brunt of the storm, with six people dead. At sea the OBOTRITA, Rotterdam for Dublin, lost eight containers overboard, 18 mi northwest of Holyhead. Three people were rescued off East Wittering, Sussex after their catamaran capsized.

Tropical Cyclones — Charley was the only tropical cyclone in the North Atlantic this month (pg. 21).

Casualties — Most of this month's casualties appear in the extratropical cyclone section. In addition the tank barge SYM was struck by lightning and caught fire on the 26th, while loading acrylonitrile on the Mississippi River. The formation of a chemical cloud forced the evacuation of 1500 residents from Kenner, LA. Another casualty of the remnants of Charley took place on the 26th when the ADONAI towed by tugs JANTAR and CHRISTINA MULLER ran a ground in a lock near Antwerp. A tow rope broke due to the strong winds.

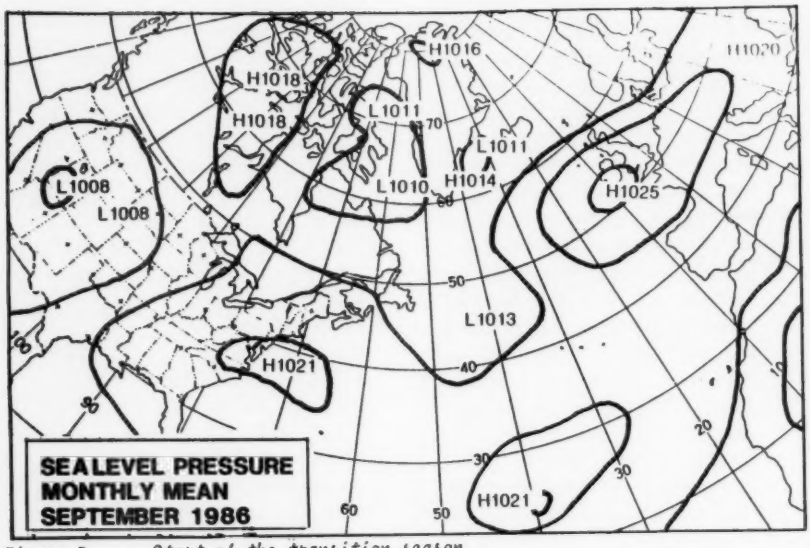


Figure 5. -- Start of the transition season.

September, 1986 -- The Azores -- Bermuda High shrank even more than expected, and its influence did not extend as far along the northern shipping routes as usual (fig. 5). However this was more than compensated for in the northeast North Atlantic by a strong high, which protected northwest Europe for a good part of the month. The anomaly chart indicated a +13 mb center just off the Irish Coast and higher than normal pressures occurred as far west as Greenland. A similar pattern emerged at 700 mb where a trough over the western North Atlantic and a ridge to the east were apparent.

On this date **- September 16, 1928 -** a monster storm known as the "San Felipe Hurricane" struck West Palm Beach, FL causing enormous damage. It had previously left 600 dead in Guadeloupe and 300 dead in Puerto Rico. It moved across Lake Okeechobee, FL and when the rains were finished, the lake covered an area the size of Delaware. Beneath its waters were 2 thousand victims. Only those reaching the big hotel for shelter, and a group of 50 people who got on a raft to take their chances in the middle of the lake, survived.

Extratropical Cyclones

-- This month's pattern was influenced by the protective high that extended west of Great Britain. The storms were either shunted north through the Denmark St or to the south of 50°N, in an area where the subtropical high was not as influential as it usually is. Activity was hot and heavy around the Grand Banks.

Great Lakes shipping had a rough time this month as a number of severe storms plowed through the region. A storm over the central plains with a strong warm front across the Great Lakes on the 11th was helping to trigger thunderstorms and severe weather over the region. In Michigan, rainfall amounts up to 13 in were creating widespread flooding (fig. 6). Water was reported 8 ft deep in Reed City and mudslides were common in southeast Wisconsin. Several tornadoes were reported in Michigan. Flooding continued for several days. The heavy rains created havoc for shipping on the Saginaw River where the WOLVERINE and LOUIS R. DESMARAIS were stuck for several days due to strong currents. Total storm damage for Michigan was estimated at $300 million.

Toward the end of the month the Great Lakes region was clobbered by a band of strong thunderstorms that extened from Ohio across northwest Pennsylvania into New York State. Thunderstorm winds gusted to 67 mph at Wooster, OH and 61 mph at Erie, PA. This was spawned by the same system that had triggered severe flooding in the northern plains a few

Figure 6. -- High water in Grand Rapids, MI, on the 11th, didn't deter fisherman Roger Wilson. Wide World Photo.

days before

This low was first spotted on the last day in August in the Denmark St , but its real effect on shipping occurred this month. By the 1st it was a large 982-mb storm centered off the northeast coast of Ireland. The sting of its gales was felt eastward to the coast of Norway. Winds of 35 to 40 kn were reported by many vessels, including the HABIB, DETTIFOSS, EYRARFOSS, LORD SUPPLIER, SVENBORG and the INGOLF. At 1200 the WALTHER HERWIG, near 62°N., 16°W encountered 36-kn westerlies in 28-ft swells that had about a 1/20 slope --steep waves. The storm began to weaken on the 2d as it turned a large counterclockwise loop in the Greenland Sea.

While the previous storm was faltering, another, which had also come to life on the last day in August, was moving in to take its place. This storm moved into the Denmark St from the south and became organized on the 3d. Moving east northeastward its central pressure dipped to 980 mb the following day (fig 7). Gales extended into the North Sea as the associated cold front made its way eastward. The PETROVSKI, near 55°N, 8°E, encountered 37-kn northwesterlies. Twelve hr later, at 1200, the OTTO WATHNE off northwestern Iceland hit 44-kn northerlies.

The central pressure of this system continued at 980 mb through the 5th as it moved erratically eastward. At 1200 the VAIGATCH, near 65°N,

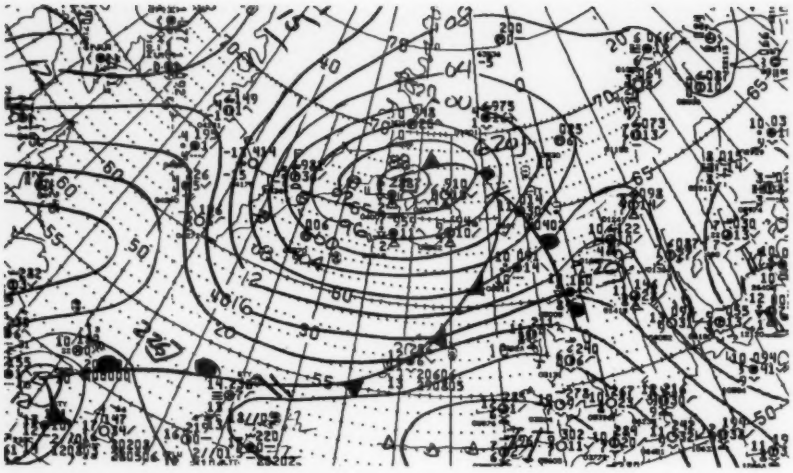


Figure 7. -- A potent LOW at 0000 on the 4th.

6°W, ran into 47-kn westerlies in 23-ft seas, with a slope of approximately 1/25; 6 hr later her winds fell to 39 kn, but the NEFTEGORSK picked up 45-kn winds near 67°N, 4°W. Even on the 6th, as the storm began to fill, the INGOLF encountered 47-kn winds. The LOW moved into northern Norway on the 7th.

This long-lived storm came to life on the 2d, just south of 40°N near 50°W. It was just one of a number of small waves that were forming along a stationary front that stretched from the mid Atlantic back into the Gulf of Mexico. For the first week of its existence the LOW moved northward towards Newfoundland then headed southward, eventually completing a counterclockwise loop, by the 7th. Central pressure had yet to fall below 1000 mb and didn't until the 10th. At this time ship reports indicated that it was finally getting things together. The EXPORT FREEDOM ran into southerly winds at 35 kn just ahead of the associated cold front.

This system was joined by another one of those waves that had developed over Georgia on the 6th. While the Georgia LOW trailed by about 2 days it was helping to create a stir. On the 10th near 37°N, 45°W the PATTY ran into 45-kn winds from the southwest and a day later hit 45-kn winds from the north northwest. By the 12th the first storm's 994-mb center was crossing the 45th parallel and heading for England, while the 1003-mb Georgia LOW was about 400 mi to the west southwest. It was moving eastward toward the coast of Spain. In addition to the PATTY, gales were being reported by the ARGONAUT, TFL EXPRESS and the SHELDON LYKES. As the first storm approached Great Britian on the 13th, shipping in and near the English Channel experienced 35-to 45-kn winds. Gales were also being reported near the second storm. However, both systems were filling as central pressures rose to above 1000 mb. By the 15th the first system had moved through the North Sea and into Finland while the Georgia LOW was approaching northern Spain.

On the 25th at 0500 and again at 0600 OSV C reported 35-kn southwesterlies on station near 53°N, 36°W. This was the beginning of a storm that came to life a few hours before along a complex frontal zone. The ZNEL, JALAVIHAR and DART AMERICA quickly confirmed this intensity with reports of 35-to 37-kn winds in swells of 13 ft. Swells at OSV C built to 20 ft during the day as gales reports filtered in from several vessels.

The storm was making its way toward the Norwegian Sea and pressure dipped to 986 mb on the 26th. A slew of reports in the 50° to 60°N latitude band came in on the 26th indicating winds in the 35-to 50-kn range. The AQABA CROWN (50°N, 3°W) encountered the

warm front associated with this storm, in the English Channel, and was hit by 50-kn northerlies. Gales continued through the 27th as the ISLE OF ARRAN experienced 45-kn south south-westerlies to the south of the center, which was turning northward. Some of the North Sea oil rigs also reported gale force winds on the 27th. At 0600 on the 28th MAXIME LITVINOV (55°N, 5°E) was hit by 48-kn south south-westerlies in the southeast quadrant. As the system made its way toward Spitzbergen it began to fill.

On the 21st a complex situation existed across the Atlantic (fig 8). Out of the twelve centers that were picked up by the analysts, one of the least conspicuous (near 40°N, 65°W) became a potent LOW. After tracking eastward for a day, it swung toward the northeast and then north. It became a well organized system by the 24th. Central pressure dropped to 984 mb and gales were occurring northeast through southwest of the center. The WALTHER HERWIG (65°N, 34°W) ran into 39-kn northeasterlies in 12-ft swells, while 120 mi southeast of the center the MANCHESTER CHALLENGE reported 45-kn southerlies in 21-ft seas with a slope of about 1/17 --pretty steep. The slope of the swells reported by the WALTHER HERWIG were about 1/25. At OSV C seas were running 21 ft with a 1/50 slope in 43-kn winds at 1500.

After crossing 60°N, on the 25th, just east of Kap Farvel the 990-mb storm turned eastward. On the 25th the WALTHER HERWIG reported 51-kn north-easterlies near 65°N, 33° W. Many other ships were encountering gales and swells up to 23 ft were being reported. The system was starting to fill, but on the 27th began to regenerate and by the 28th, in the Norwegian Sea was sporting a 976-mb center. At 0000 on the 28th some twenty gale reports were radioed in. Winds ranged from 35 to 45 kn, throughout the Norwegian and North Seas. The strongest wind was reported by OLAVUR HALGI, at 0600, near 62°, 7°W, where she was hit by westerly winds at 52 kn.

Monster of the Month

-- This intense LOW formed the Gulf of Maine on the 24th. It intensified slowly as it moved eastward for 2 days. On the 26th the storm recurved westward and stalled. Then late on the 27th and 28th it deepened rapidly. By 1200 on the 28th central pressure was down to 974 mb. Gale reports flooded in and storm force winds were not uncommon. The Grand Banks was being clobbered (fig 9). The old reliable SEDCO 710 came in with a 68-kn northwesterly wind with a 985 mb pressure in 21-ft seas. At 0900, just 3 hr prior to the SEDCO's report one of the VSBC rigs reported 72-kn north-westerlies with a

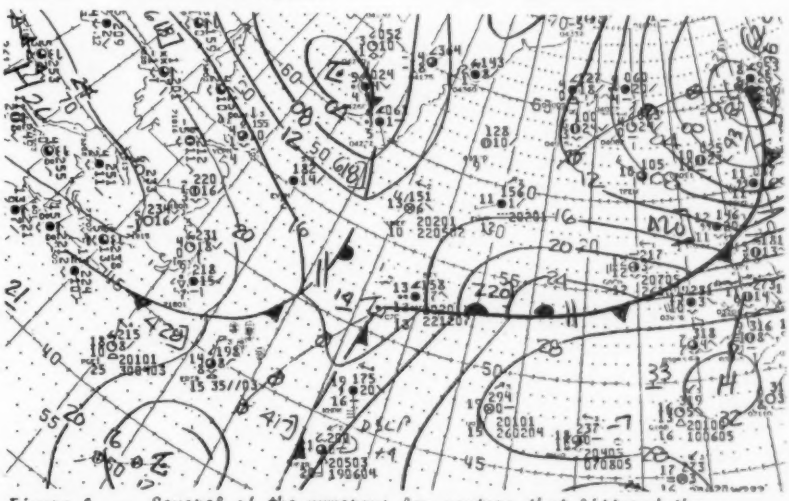


Figure 8. -- Several of the numerous low centers that littered the Atlantic at 0000 on the 21st.

983-mb pressure, and the SEALAND EXPRESS provided further confirmation with a 70-kn reading near 47°N, 48°W. To the southwest of the center the SEALAND PACER indicated extremely steep seas of 20ft and swells of 33 ft in 40-kn winds; these waves should have been breaking. Gales continued through the 29th as the system made its way rapidly northward. The following day it sped through the Denmark St.

Tropical Cyclones — In what is usually the "hot" month in the tropical North Atlantic only two cyclones came to life -- tropical storm Danielle and hurricane Earl. Usually three or four storms come to life and as many as six have been observed several times. Danielle can be traced back to a disturbance that came off the northwest coast of Africa around the 1st. It wasn't classified as a tropical depression until the early morning hours of the 7th, but it quickly gained tropical storm strength that same afternoon. Danielle attained maximum strength on the 8th, just east of the Windward Is, when maximum sustained winds were estimated at 45 to 50 kn. However, aircraft reported that there

Figure 9. -- The monster caught in the act of deepening rapidly at 0200 on the 28th. Courtesy of the Satellite Applications Lab.

was a band of heavy squalls approaching hurricane force just north of the center as the storm moved through the Windward Is. These squalls caused a major power outage on St Vincent. A Barbados Coast Guard ship, GEORGE FERGUSON, ran aground in the Grenadines but the crew was saved. As the storm began to accelerate through the western Caribbean it began to weaken. By the 10th there was little evidence of a circulation.

Another African tropical wave spawned hurricane Earl. The system became an organized tropical depression on the 10th near 20°N, 50°W (further details can be found on page 23).

Casualties — The cargo vessel MIGHTY SERVANT 3, from Rottendam to Norfolk, sustained damage alleged to have occurred in an encounter with ex hurricane Earl on the 19th. The damaged was to a floating dry dock onboard the vessel. During Danielle the Coast Guard patrol vessel GEORGE FERGUSON grounded on Tobago Cays as reported in the write up. The 10-man crew were taken off.

North Pacific Weather Log
July, August, and September

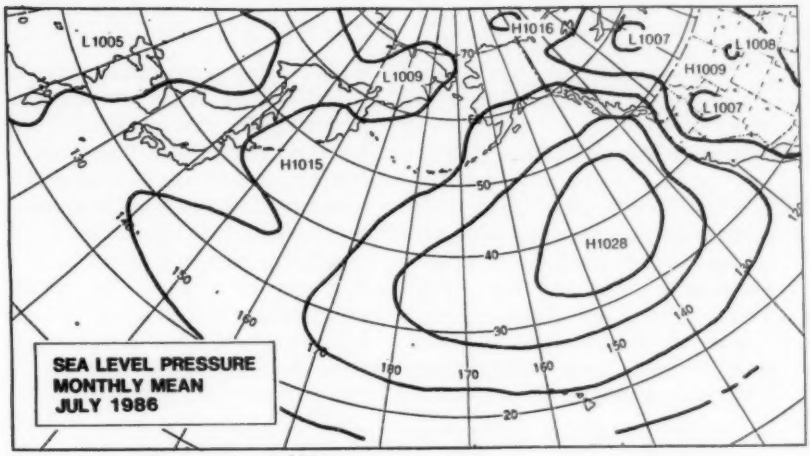


Figure 1. -- The summer of '86.

July, 1986 -- As usual the subtropical high dominated a good portion of the North Pacific (fig. 1). It was centered slightly east of normal resulting in some slight anomalies, positive off the northwest U.S. coast and over the Alaska Peninsula.

On This Date -- **July 30, 1965** -- Portland, OR reached 107°F to equal their all time record high. This was due to a heat wave that had developed over the Pacific Northwest -- readings in the Washington-Oregon area ran into the 90's and over 100°F at several locations.

Extratropical Cyclones -- While there was plenty of cyclonic activity, very few systems caused real problems. For a good portion of the month a stationary front spawned weak atmospheric waves between Japan and the Gulf of Alaska. Several of these waves briefly flared and caused heavy weather for a short period, but only a few became full-fledged storms.

A system that was stationary and lethargic for several days at the beginning of the month flared up briefly and generated gales near the Aleutians. On the 4th, the PACIFIC SUNSHINE encountered 41-kn west southwesterlies near 49°N, 155°W. The DAVID PACKARD reported east southeast winds at 51kn (48°N, 156°W) 6 hr later.

From the beginning of the month a stationary front was stretched across the Pacific from British Columbia to southern China. Several waves formed along this meandering frontal zone. It wasn't until the 7th that one

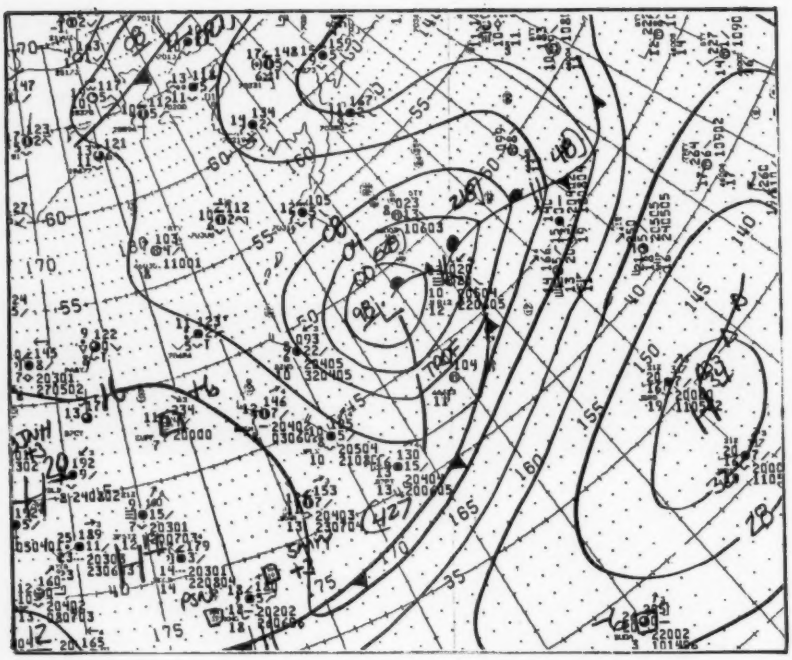


Figure 2. -- Heading for the Gulf of Alaska at 0000 on the 9th.

of these waves organized enough to become a headache to shipping in the Gulf of Alaska. On the 9th the HARMAC DAWN (53°N, 157°W) encountered a 63-kn northeasterly. Gales were reported by several vessels as the storm tracked northeastward (fig. 2). The JOHN N. COBB at 0000 on the 10th, in one of the inlets between Sitka and Juneau, picked up a local effect and reported a 70-kn northerly. Along the coast southeast of the storm's center, several vessels encountered 40-to- 60-kn winds. The HANJIN POHANG (48°N, 140°W) reported 47-kn westerlies in 20-ft seas and 26-ft swells; in both cases the slope works out to about 1/100. On the 11th the system moved ashore just east of the Queen Charlotte Is.

Another wave got organized along the western portion of the front on the 17th, near 38°N, 160°E. Early on, the SKAUGRAN, HAKONE MARU and the JQVW encountered winds in the 35-to 45-kn range. At 0000 on the 18th, near 44°N, 176°E, the JQVW, which had turned in several valuable observations, encountered 62-kn south southeasterlies in 13-ft swells; at this time she was some 300 mi southeast of the storm's center. The gradient to the east of the storm was enhanced by a strong 1041-mb HIGH (fig. 3). Gale and storm reports flooded in. The strong winds were confirmed by one of the ELDA vessels, near 52°N, 176°E at 0600, when she ran into 57-kn southerlies in 23-ft swells, with an estimated steep slope of 1/14. While gale reports continued during the day, it was apparent that the storm was starting to weaken as it moved away from the HIGH.

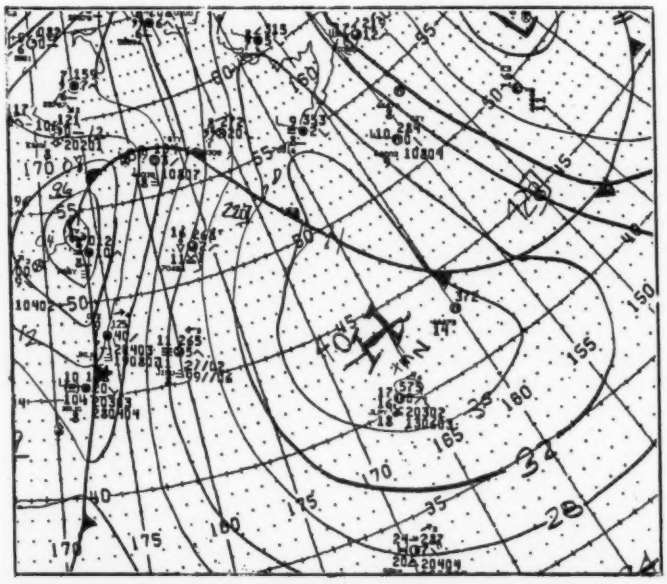


Figure 3. -- The HIGH tightens things at 1200 on the 18th.

It moved through the western Bering Sea and, on the 20th, into the Chukchi Sea.

Tropical Cyclones --

Six tropical storms and hurricanes, or typhoons, came to life. Two hurricanes and a tropical storm roamed the eastern waters, while two typhoons and a tropical storm developed in the west. This is slightly below normal, due to the lack of activity in the west.

Darby was a short lived eastern Pacific tropical storm that just made minimal storm intensity. The system organized on the 3d and headed toward the west northwest. Late on the 5th maximum winds climbed to 35 kn and remained there for about 12 hr. The system dissipated before reaching 120°W.

Hurricane Estelle began in the east and ended up threatening the Hawaiian Is. The storm reached hurricane strength on the 18th and maintained it until late on the 23d. During this period the hurricane moved on a west northwesterly track. By the 20th (fig. 4) winds were up to 115 kn and the following day the system moved about 120 mi south of the South Cape of the island of Hawaii. The hurricane was already weakening and by the 25th had dropped all the way back to depression stage.

Hurricane Frank also moved into central Pacific waters to the Hawaiian Is. Frank came to life on the 24th but didn't reach hurricane strength until the 30th. on the 31st Frank's winds climbed to a peak of 75 kn. Frank was able to maintain hurricane strength until the 1st of August but dropped to tropical storm intensity and then a depression before crossing the 20th parallel on the 2d.

Typhoon Peggy came to life on the 3d east of the Mariana Is. Intensifying as it moved west northwestward the system reached typhoon strength after passing over the island chain on the 4th. Peggy followed a predictable path toward northern Luzon. On the 6th Peggy's winds climbed to an estimated 130 kn near its center. The following day the storm peaked at 140 kn. The SHINRYU MARU, at 0000 on the 8th, encountered 40-kn southerlies near 16°N, 128°E; seas were estimated at 20 ft, with an estimated slope of 1/15. The INDIO hit 50-kn southeasterlies

Figure 4. -- Enhanced view of Estelle and its environment at 1331 on the 20th. Courtesy of Satellite Applications Lab.

in the Luzon Strait, on the 9th, as Peggy swept across the northern Philippine Is. The following day the INDIO continued to report 50-kn winds as she battled seas up to 23 ft. Peggy maintained typhoon force until the 11th and was a super typhoon on the 6th and 7th.

While Peggy was coming ashore over southern China, Roger was developing within a few miles of Peggy's origin. However one week can make a big difference in the steering patterns. Roger ended up moving northwestward and recurving over southeastern Japan. The storm reached typhoon strength at 0000 on the 14th and maintained this intensity into the 16th. Maximum winds were estimated at 85 kn on the 15th at 1200. On the 16th the PRESIDENT PIERCE sent in several helpful observations. At 0000 near 27°N, 129°E she encountered 50-kn east southeasterlies in 16-ft swells. Roger turned extratropical off Tokyo on the 17th.

Tropical storm Sarah developed over the Philippine Sea on the 30th. It reached tropical storm strength on the 1st shortly before moving across northern Luzon. Sarah did not follow the usual path across the South China Sea but reversed its course and headed northeastward. Winds reached an estimated maximum of 50 kn on the 3d. The following day Sarah weakened to a depression east of Tokyo.

Casualties --The MINT PROSPERITY, loaded with 369 thousand barrels of crude oil collided with the ROANOKE in thick fog 5 mi south of the Long Beach harbor on the 2d. No injuries were reported. On the 11th fog was present when the SANYU MARU NO. 1 collided with the KIYOTAMA MARU about 16 mi from Daito-zaki lighthouse on the Boso peninsula. A few days later on the 14th in the Kurushima Straits of Japan's Inland Sea (fig. 5) the Ferry DIAMOND OKUDOGO 6 collided in fog with the chemical tanker SANTEN MARU; a third vessel -- the ISE MARU was also involved. Two people were injured and some chemicals were spilled. On the 19th the ferry SAIKI brushed the JUTHA PHANSIRI in dense fog near 33°N, 132°E. Both vessels sustained serious damage.

Figure 5. -- A collision in fog in the Kurushima St on the 14th. Wide World Photo.

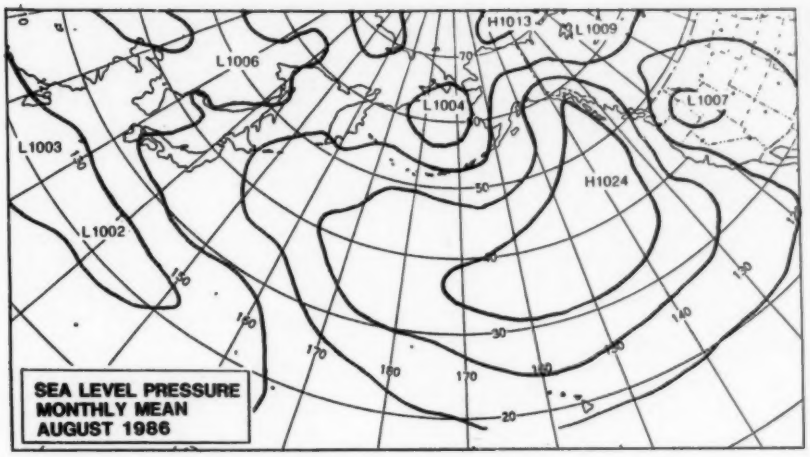


Figure 6. -- A scene that is not how it first appears.

August, 1986 -- At first glance the mean chart (fig. 6) looks like a typical mid summer month. On closer inspection there are some subtle differences that account for this month's weather. The most apparent discrepancy is the large band of low pressure from southeast Asia eastward across the Philippines to about 150°E. This area represents anomalies in the -3 to -8 mb range and reflect some intense tropical cyclone activity. Higher than normal pressure occurred over the northwest North Pacific and eastern Gulf of Alaska. However in the Bering Sea and south of the Alaska Peninsula readings were lower than normal, reflecting a concentration of extratropical activity in these regions. In the steering level (700mb) this is reflected by a trough, which is normal over the Bering Sea, that digs south of the Alaska Peninsula.

On This Date --**August 1, 1959** -- One of the most violent hurricanes to affect the Hawaiian Is. occurred in August, 1959. In this pre-satellite era, it was the excellent weather reports from the SS SONOMA that provided several days of advance warning. From 1800 on the 1st through 1200 on the 2d the vessel made special reports every 3 hr. Hurricane Dot had escaped detection from its depression stage until it reached full hurricane strength. While the damage to the Islands totaled $6 million no deaths or injuries were reported.

Extratropical Cyclones -- While extratropical activity was plentiful in the Bering Sea and Gulf of Alaska, it was infrequent along the major shipping routes -- and what there was caused few headaches.

The worst weather of the month was reported in northeastern China where July and August rains were responsible for devasting floods. Early in the month the flooding was concentrated in northeast Inner Mongolia, where 30 people were presumed drowned. Later in the month it was reported that floods had ravaged Jilin, Heilongjiang and Liaoning Provinces; 80 people had been killed before the floods started to recede around mid month.

As July ended this system was a weak wave along a front in the southern Bering Sea. By the 1st it was a 992-mb LOW heading for Nunivak Is. By the 3d the system, now down to 982 mb, had stalled. It covered most of the eastern Bering Sea (fig. 7) and a cold front swung across the Alaska Peninsula and extended into the shipping lanes. To the south swells were running up to 13 ft. The system began to fill and move northward on the 4th. By the 6th it had crossed the Bering St. and was heading for the Arctic Ocean.

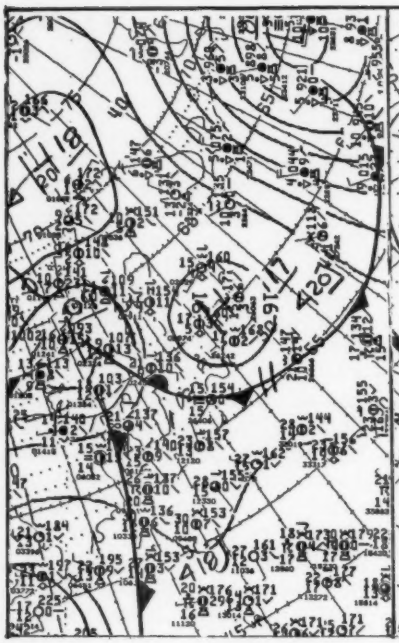


Figure 7. -- Cold front extends across Alaskan Peninsula at 1800 on the 3d.

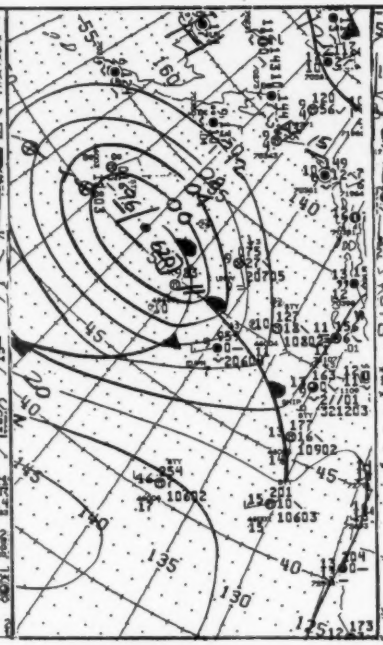


Figure 8. -- LOW prior to turning northwestward at 1200 on the 9th.

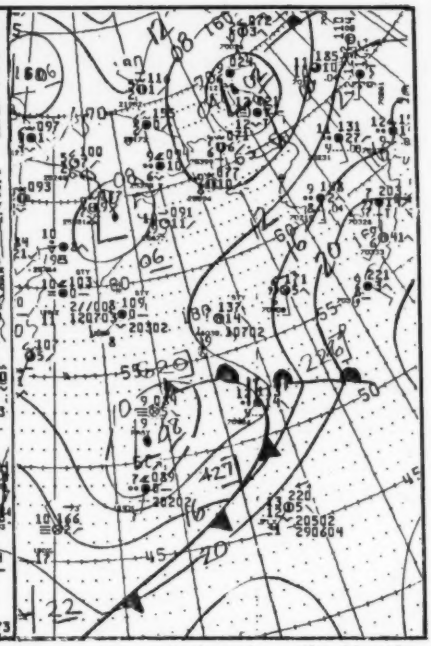


Figure 9. -- Moving along the Aleutians at 1200 on the 24th.

The 8th dawned to a rather complex weather situation over the northern North Pacific. A LOW had formed along an east-west stationary front just south of the Aleutians. There was another system in the Gulf of Alaska and a third in the northern Bering Sea. The DANIEL SOLANDER and the PACIFIC ATAAWHAI, to the south of the main center at 1200, encountered 35-to 45-kn winds in 12-ft swells. Twelve hours later the POLER ACE ran into the 38-kn west southwesterlies in 13-ft swells.

The storm's center had been moving eastward just south of the Aleutians. On the 9th it turned northward across the Alaska Peninsula and into Bristol Bay (fig 8). The AKADEMIK SHOKALSKIY, near 56°N, 154°W, at 0000 on the 10th ran into a 47-kn southeasterly in 12-ft seas. The system moved inland on the 10th and survived for two more days. It eventually moved across the Bering St on the 12th.

The end of the month became very complicated in the Bering Sea and Gulf of Alaska. A storm that had moved up the Kamchatka Peninsula on the 21st triggered the development of a LOW in the northwestern Bering Sea on the 23d. This system intensified as it headed eastward then southward over the next few days (fig 9). Meanwhile over the Gulf of Alaska, late on the 24th, another LOW was developing rapidly. The GLOBAL FRONTIER can testify to this as she encountered 50-kn winds in 20-ft swells with about 1/20 slope. The GLOBAL FRONTIER continued to keep forecasters apprised of the situation the following day as she reported 45-kn measured winds in 20-ft seas and 21-ft swells. This was confirmed by the VERRAZANO BRIDGE (42°N, 156°W), which also measured 45-kn winds in 20-ft seas.

The Bering Sea storm was now beginning to weaken and stall over the Aleutians on the 26th. The Gulf of Alaska storm, meanwhile, had moved across the Alaska Peninsula and into Bristol Bay -- two

storms that pass in the night. The Gulf of Alaska storm was now the dominant LOW. At 0000 the FRANCIS SINCERE NO. 6 (54°N, 154°W) reported 43-kn easterlies in 10-ft seas. At 1200 the FAIRWEATHER battled 38-kn northeasterlies in the northern Gulf of Alaska. By the 28th the Bering Sea storm had dissipated while the Gulf of Alaska storm was weakening over Norton Sound.

Tropical Cyclones --

A total of eight tropical cyclones developed over the North Pacific. In the west there were three typhoons while the east spawned four tropical storms and a hurricane; nine is about normal.

By far the most interesting storm of the month was the eastern Pacific's typhoon Georgette. A typhoon in the east? The story goes like this. Once upon a time there was a rather innocuous tropical storm that came to life in the eastern Pacific. Just as it crossed the central Pacific border this minimal system dropped back to depression strength. That was on the 4th. Soon it wasn't even organized enough to issue warnings about. However, the cloud mass stayed intact and, on the 9th, reorganized after crossing the Dateline. Given a second chance Georgette took advantage. It reached typhoon intensity on the 11th, southeast of Wake Is. Winds near the center climbed to 70 kn for awhile on the 12th. Fortunately by the 13th Georgette was downgraded to a tropical storm as it passed Wake and headed westward. The system hung on for another day before finally dissipating.

Howard was a short-lived tropical storm that organized south of Manzanillo on the 16th. These storms are potentially dangerous when they form close to the coast. However, after reaching minimal tropical storm strength (35 kn), Howard paralleled the coast on the 17th and 18th and never intensified further.

A few days after Howard's demise, Isis came to life near 15°N, 115°W. There was one stroke against it already -- its northerly and westerly birthplace. Isis reached tropical storm strength on the 20th and was able to maintain this identity for several days as it moved west northwestward. Maximum winds reached 45 kn on the 21st and 22d. However the following day the system began to weaken.

Javier actually came to life on the 20th as Isis was just starting. However, Javier began on the 10th parallel, east of 100°W. With this beginning the storm was able to develop properly and, on the 21st, became a hurricane. Winds continued to increase as the storm moved toward the west northwest and then jogged northward. By the 25th (fig. 10). maximum winds were estimated at 115 kn. Isis had dissipated by this time. Javier turned back to the

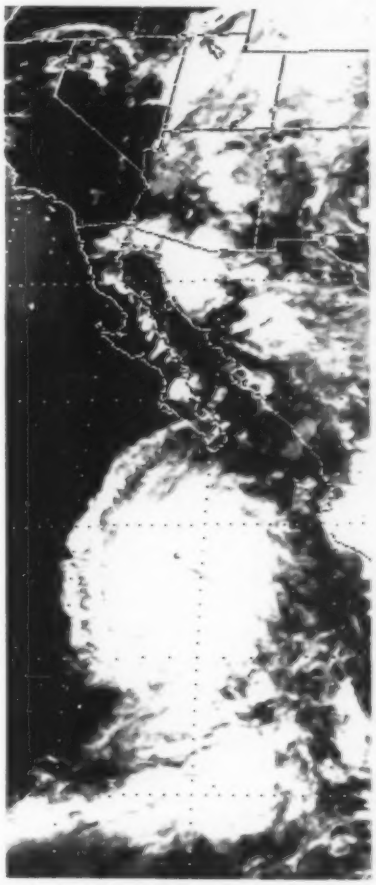


Figure 10. -- Javier on the 25th.

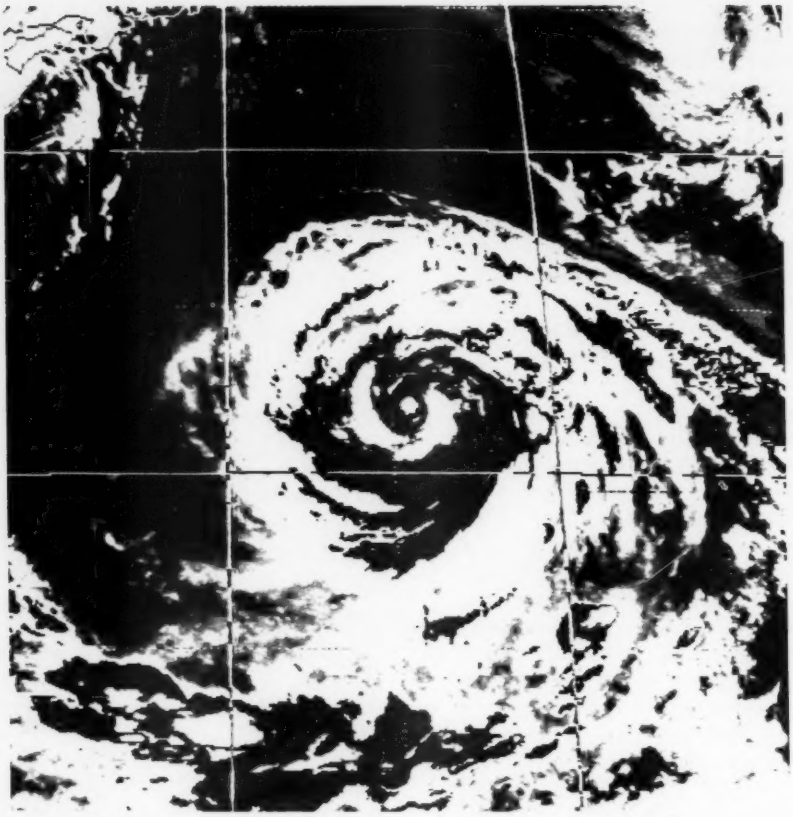


Figure 11. -- Vera, a classic typhoon, on enhanced IR on the 22d. Satellite Applications Lab.

west northwest, and maintained hurricane strength into the 28th. The system was north of 20°N by this time and conditions were no longer right for continued support. The storm weakened over the next few days.

While Javier was weakening another system was coming to life near Clipperton Is, on the 28th. This was close to where Javier had passed when at full strength on the 25th. Once again however, it is not a good place to begin. Kay did make it to tropical storm strength but only for a short while from the 30th through the 1st. Maximum winds reached 40 kn during this period as Kay moved slightly north of west. The system hung together until the 2d, near 20°N, 130°W.

Typhoon Tip was a short-lived storm that developed on the 13th. It reached typhoon strength on the 16th as it moved very close to Marcus Island. Later in the day winds reached a maximum of about 75 kn, with gusts to 90 kn. The following day the typhoon, which had been heading north northwestward, turned toward the east northeast and began to weaken. This turn was influenced by the mid and upper level southwesterly flow. An influx of drier air into the storm began to weaken it as it lost its tropical characteristics.

Vera popped up in the Philippine Sea late on the 15th. By the 18th the tropical storm had moved to near 24°N, 138°E. Vera reached typhoon strength on the 20th and appeared to be heading toward the open Pacific. Then, on the 22d, the system did an about face and headed westward (fig 11). Under the ridge of high pressure to the north, Vera moved through the Ryukyu Is on the 25th and 26th. Once into the East China Sea the typhoon began to weaken and recurve. On the 28th, as a tropical storm, Vera moved across South Korea. The following day, in the Sea of Japan, Vera weakened to a depression.

Vera was a major typhoon as can be seen in the casualty reports. In additon to maintaining typhoon intensity from the 19th through the 28th, the storm reached a peak of 130 kn -- super typhoon intensity -- on the 23d.

Typhoon Wayne was a screwball of a storm. Take a look at its track and you'll agree. Wayne started out in the South China Sea on about the 18th. It ended up over Vietnam on the 6th of September. In between it brushed Hong Kong, moved over northern and southern Taiwan and went throught the Luzon St three times. During this interlude Javier and Kay in the east and Vera in the west all came to life and died.

On the 21st Wayne's winds hit an estimated 85 kn. The storm fell back to tropical storm strength on the 23d and to depression intensity the following day. On the 28th the system regenerated off northern Luzon and was a typhoon again by the 31st (fig 12). Winds near the storm's center reached 80 kn. Wayne weakened slightly as it passed close to northern Luzon on the 2d. However, by the 4th, in the open sea, winds were back up to 85 kn. Two days later the storm finally moved inland. Casualties were heavy around Taiwan. In addition to what was reported in the Casualty section, the JUPITER ACE, with a cargo that included 300 cars, grounded south of Taichung. In the Pescadores it was estimated that some 500 fishing vessels sunk and another 500

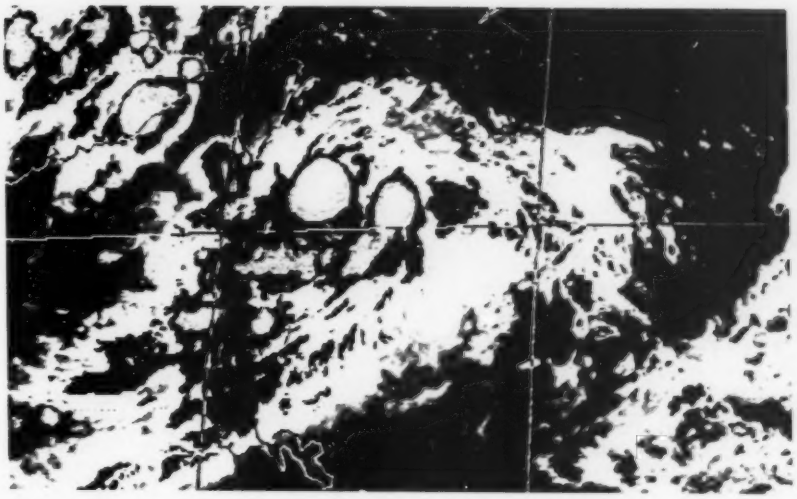


Figure 12. -- Typhoon Wayne southeast of Taiwan on the 31st. Satellite Applications Lab.

were damaged. Also the PRESIDENT TAFT was reported to have sustained heavy weather damage on the 21st, before running into Vera on the 26th.

In northern Luzon about 10 thousand farmers suffered crop damage as Wayne's rains flooded more than 42 thousand acres of rice land. Also 90 percent of the commercial fish ponds in six provinces were destroyed. Taiwan was hardest hit as 515 fishing vessels capsized and 39 people were killed with 10 missing.

Casualties -- In the Philippines, on the 1st, the passenger-cargo vessel BEATRIZ was reportedly listing to starboard and sank after being battered by large waves between Cebu and Leyte. One hundred and fifty-two passengers were rescued while three were confirmed dead and seven listed as missing. The coaster TORAYOSHI MARU ran aground near Hirado in rain and poor visibility but was refloated on the 2d.

After Sarah passed over Pacific coast of Japan, on the 5th, six crop-dusting helicopters were found submerged along the River Abukuma-gawo, Iwanuma, Miyagi Prefecture. On the 14th the CHEVRON COLORADO, loaded with 8 million gallons of oil, collided with an empty barge in dense fog near the mouth of the Columbia River. Both vesels were damaged in the bow to bow collision but no one was injured and no oil was released.

Several incidents occurred in typhoon Vera. The NEW GENSHINE got caught in the stormy East China Sea on the 27th. It had reportedly sent a

message saying: "In the worst situation. Waves washing the bridge. May abandon ship." Patrol planes were sent out from Japan for several days, to search for the missing 25-man Filipino crew. On the 31st one of the planes spotted and empty lifeboat and two floats from the missing vessel. The ISHIMINE No. 2, anchoring at a port of refuge along the Japanese coast, dragged anchor and ran aground on the 26th. At about the same time the NANKO MARU, in Nago Bay, did the same, as did the KINSHO MARU near Kouri-jima. Other vessels that grounded included the HONGKONG CONTAINER, HAE BARAKI, PANAMA VICTORY, and BERGE LORD. Off South Korea the drilling platform NORJARL was driven agound while the PRESIDENT TAFT, Hong Kong for Seattle, sustained heavy weather damage. The TA TONG foundered on rocks off Naha in the stormy seas but the 11-man crew was rescued by a Maritime Safety Agency helicopter on the 26th.

A few problems were also caused by typhoon Wayne. At Kaohsiung the VIXEN broke her moorings on the 22d and hit the HAI LEE and RACOON causing minor damage. The HAWK was reported to have sunk at Pa Tou Tze on the 22d. On the 21st in the Philippines, between Butuan City and Camiguin Is ,the SANTA FE, loaded with plywood, capsized and sank after reportedly encountering big waves and strong winds. Ten crewmen were rescued, three dead and thirteen missing.

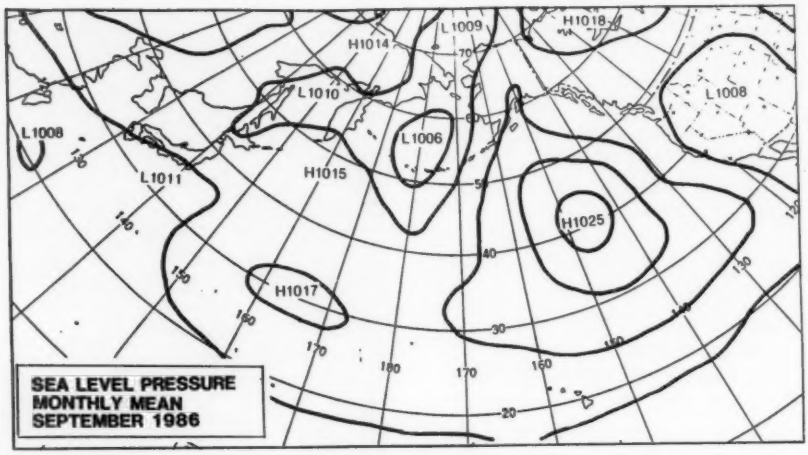


Figure 13. -- Good weather for the Gulf of Alaska.

September, 1986 -- The Gulf of Alaska, recipient of many nasty weather surprises, received a nice one this month when the subtropical high pushed farther north than normal for a good part of the month (fig. 13). The result was a +10mb anomaly centered just southwest of the Alaska Peninsula with positive readings covering the entire Gulf. In addition to this, the high itself was stronger than normal. While some of this good fortune spilled westward into the eastern Bering Sea, most of this sea was under the influence of a displaced Aleutian Low which reflected storm activity similar to the previous month. Elsewhere over the Pacific, pressure patterns were near normal. The 700 mb level reflected the surface anomalies.

On This Date --
September 25, 1939-- An unusual West Coast hurricane moved onshore south of Los Angeles bringing uprecedented rains along the southern California coast. The hurricane caused $2 million in damage and claimed 45 lives at sea. In Los Angeles nearly 5½ in of rain fell in a 24-hr period.

Extratropical Cyclones -- Similar to last month the Bering Sea was the focus of a good portion of the storm activity. The 700-mb chart indicated a normal flow across the western North Pacific and this was

apparent along the 40°N latitude band. The hole in the Gulf of Alaska activity was sponsored by the subtropical high, which protected this normally active region.

The Pacific picked up where it left off the previous month, when a LOW developed over the southern Bering Sea on the 2d. On the 3d the central pressure was down to 992 mb and by the 4th it had dropped to 987 mb (fig 14). The BORISSOV 61°N, 180°) hit 54-kn northerlies in 16-ft seas on the 5th. The PRESIDENT GRANT reported southerly winds at 40kn southeast of the center. The storm was now heading northward. Gales continued to be reported by such vessels as the KHAIRIOUZOVO, MALKI, DAIRIN MARU and the AFRICAN HIGHWAY. Early on the 7th the 992-mb center passed near St. Lawrence Is on its way through the Bering St. At 0000 on the 8th the BORISSOV now near 62°N, 177°E encountered 39-kn west northwesterlies.

A system that had its origins in the tropics at the end of last month, came to life for several days after recurving just east of Honshu. On the 3d a flurry of gale reports came in from such ships as the IVAN SKOURIDINE, KRASKINO and the JAOC. At 0600

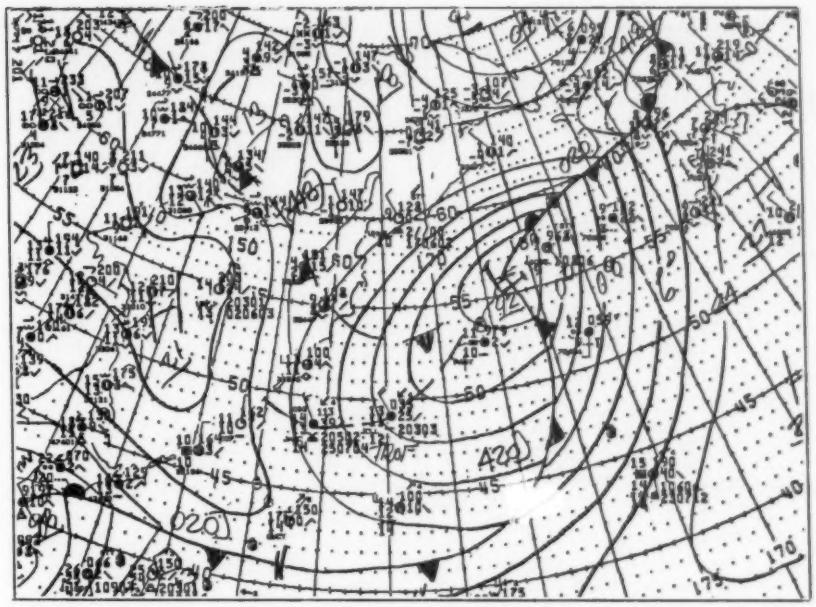


Figure 14. -- The synoptic situation at 1200 on the 3d -- just before the storm deepened.

on the 4th, the NIMAS (43°N, 146°E) encountered 47-kn northeasterlies in 20-ft seas with a slope of about 1/7, which means they should be breaking. The PROFESSOR KOJINE a few hours later observed 16-ft seas with a slope of about 1/20; winds were 39 kn. The MANILA SUCCESS hit 50-kn westerlies near 37°N, 149°E at 0900. The storm was moving eastward across the Pacific and crossed the Dateline late on the 6th. Gale reports tailed off on the 7th; the system kept its identity until the 10th.

Ahead of the front that spawned this storm on the 11th, the ORIENTAL EXECUTIVE hit 44-kn southerlies near 42°N, 175°E.A few hours later an organized LOW was detected. To the west of the center, the SURUGA MARU reported 37-kn winds from the northwest while the AKASHIA ACE to the southeast hit 45-kn southerlies. The storm intensified as it headed northward (fig. 15). At 0600 on the 12th, the HIKAWA MARU, JFLL and the PERENNIAL ACE encountered 36- to 38-kn winds. The HIKAWA MARU ran into 16-ft swells with a slope of about 1/10. Once again we heard from the BORISSOV,

near 62°N, 167°E, at 1800 on the 13th; she reported 47-kn northerlies. After crossing 60°N, on the 14th, the 978-mb center turned a counter clockwise loop during the next few days.

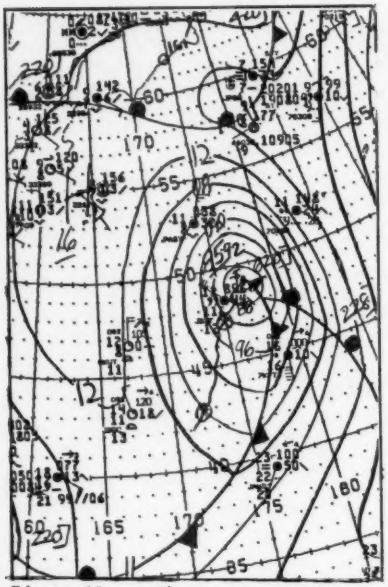


Figure 15. -- The storm at 1200 on the 11th.

On the 13th a LOW came out of Honshu as a wave along a stationary front. It was heading toward the east northeast. It was destined to merge with the previous storm in the Bering Sea on the 17th. However, it did cause some problems for shipping before that merger. At 1800 on the 15th, the PACIFIC ATAAWHAI encountered 50-kn east southeast winds in 23-ft swells with a slope of about 1/4. Six hours later the vessel was reporting 49-kn winds, while the WFPZ, nearby, hit 40-kn southerlies. On the 16th the system swung northeastward and headed for its liason in the Bering Sea.

This system formed east of northern Honshu on the 18th. Again it was just a wave along a front. However, this storm not only developed but also picked up a partner on the 20th. On the 18th the SEALAND MARINER and the KOHO MARU among others were reporting winds in the 35-to 40-kn range. At 0000 on the 20th the QUEEN OPAL (39°N, 165°E) ran into 43-kn east northeasterlies in 12-ft swells with a slope of about 1/20. The MAPLE ACE, nearby, picked up 39-kn winds in 10-ft swells. The second center developed just to the east of the Honshu LOW. It maintained its identity for several days as the two began to swing northward. On the 21st they created some rough weather between 30° and 45°N from about 160°E to 160°W. The NEPTUNE DIAMOND at 0000 on the 22d, some 500 mi east of the second center, was encountering 58-kn southerlies in 12-ft seas. The CLARO about 200 mi east of the Honshu center, reported a 70-kn blow in 18-ft seas; however close to this center the JABE was reporting 41-kn north northwesterlies. The second storm, by the 22d, was turning eastward and beginning to fill. However, the initial Honshu LOW kept going for another week before moving through Bristol Bay and over Alaska. It seemed to reach its peak on the 22d (fig. 16) when central pressure fell to 986 mb. Scattered gale reports continued but this storm was relegated to the minors by a major league system.

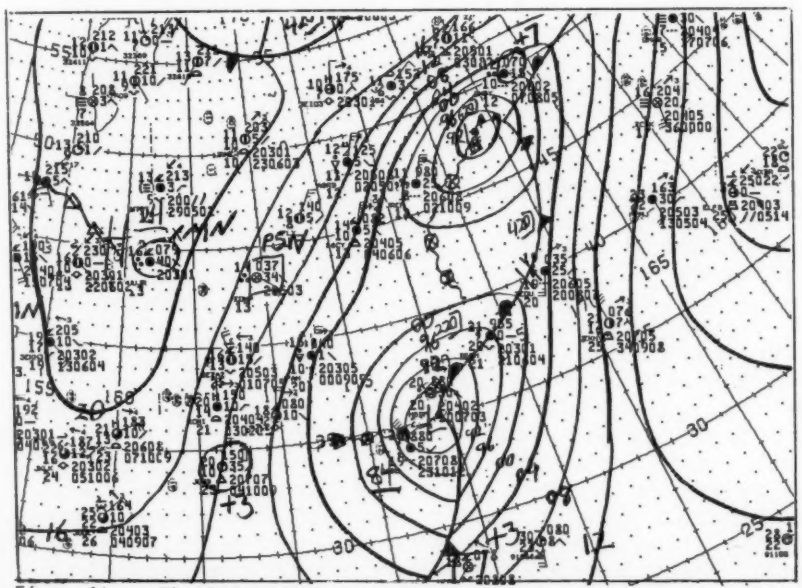


Figure 16. -- The double system with the Honshu LOW to the south and taking over at 0000 on the 22d.

This low started off inconspicuously on the 18th, near 40°N, 173°W, and made its way into the Gulf of Alaska while the double-centered system occupied center stage. However, by late on the 23d a large number of gale reports started coming in from the Gulf of Alaska. The KEE LUNG, near 53°N, 149°W, hit 52-kn west northwesterlies at 1800. Central pressure fell from 994mb on the 21st to 972 mb on the 23d; this was a major league system.

In general the windspeeds ranged from 35 to 45kn. Storm force winds were more common the following day as the storm continued its coastal tour of southern Alaska. The BALANCHE, for example, at 0000 on the 24th ran into 55-kn northwesterlies near 51°N, 140°W; in 33-ft seas (slope 1/20) and 55-kn winds the WXBX kept sending in reports. The storm was battering the entire eastern Gulf as well as the nearby coast (fig. 17). At 1800 no less than 14 ships radioed messages of gale and storm force winds. Its presence was felt as far south as San Diego where .9 in of rain set a new record for the 25th and was the second highest for any day in September. The 1.95 in total at Los Angeles set a new record for the day. The storm also produced up to 18 in of snow on the higher peaks of the Sierra Nevada Range. Conditions began to improve on the 26th as the storm moved inland along the U.S.- Canada border.

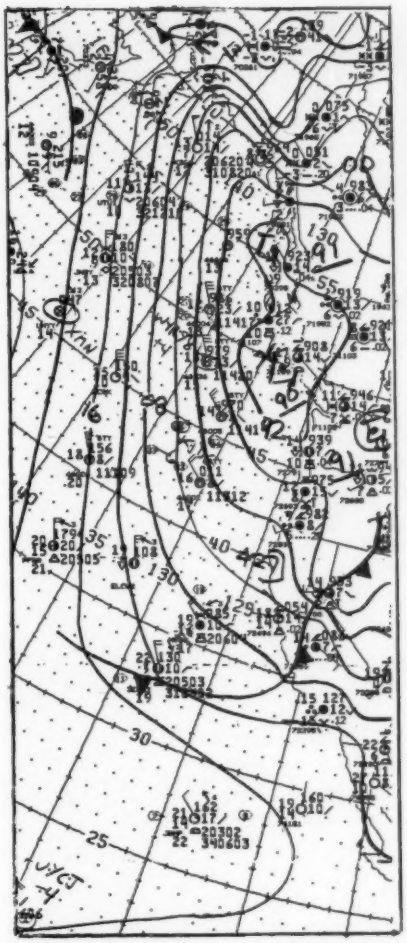


Figure 17. -- From the Gulf of Alaska to Southern California, this system created havoc at 1800 on the 24th.

Tropical Cyclones --

Seven tropical cyclones came to life and four reached hurricane, or typhoon, intensity. The big news was that only two of these, one typhoon and one tropical storm, occurred in the west. This is a basin that peaks in September and averages five tropical cyclones, of which three to four become typhoons.

Lester was another one of those quickies that seem to have been prevalent in the east this season. Forming near the 14th parallel helped seal its fate. Lester reached tropical storm intensity on the 14th and held it for 2½ days. Winds peaked at about 45 kn on the 15th.

It was about the time that Lester was peaking, on the 15th, that Madeline was first spotted. Madeline became a tropical storm late on the 16th. It continued to intensify while moving toward the west northwest. By the 18th Madeline came near to being a hurricane, when winds climbed to 60 kn. However, the following day as the system crossed the 15th parallel it started to weaken. Madeline hung on as a tropical storm for several more days but on the 22d it fell back to a tropical depression.

By the 18th, when Madeline was rolling, Newton put in an appearance just south of the Gulf of Tehuantepec. Newton became one of those dangerous coastal huggers. The system

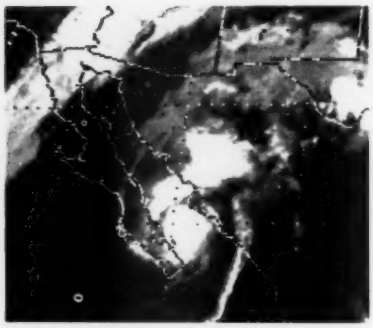


Figure 18. -- Newton in the Gulf of California at 0430 on the 23d.

reached hurricane strength on the 21st, about 100 mi southwest of Manzanillo. The storm threatened the coast as it moved northward. On the 23d (fig. 18), as it moved into the Gulf of California, maximum winds climbed to 75 kn. Later that day the hurricane moved inland near Ciudad Obregon.

Hurricane Orlene was first detected as a tropical depression on the 21st near the border between the eastern and central waters (140°W). The system intensified quickly and before the day was out, hurricane Orlene was in. The storm was moving northwestward. Maximum winds reached an estimated 70 kn on the 22d and 23d. However, as Orlene turned westward on the 23d it began to weaken rapidly. By the 25th sustained winds had dropped to 25 kn.

Hurricane Paine was first detected as a depression on the 28th in one of the more favored spawning grounds. Early on the 30th near 13°N, 106°W Paine reached tropical storm strength. It had turned toward the northwest when it became a hurricane later that same day; the center was about 180 mi west southwest of Manzanillo. The storm continued to intensify. By the 2d maximum winds were estimated at 85 kn while gales extended out to 130 mi from the center, which was fast approaching the tip of Baja California. Later in the day the storm moved inland just south of Los Mochis.

Typhoon Abby developed over the Mariana Is about mid month. The storm moved west northwestward through the Philippine Sea. It attained typhoon strength on the 16th and maximum winds reached 95 kn by the 18th. At this time Abby was bearing down on Taiwan, which was just recovering from typhoon Wayne.

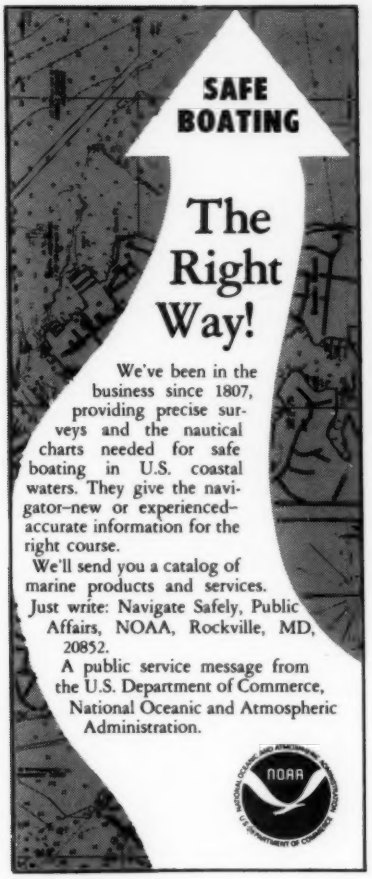
The eye of the storm passed over the southeast coast near Taitung, bringing gusts to 100 kn and torrential rains. Electric power and rail service were cut for a few hours but damage was not considered serious.

The trek across the rugged island weakened Abby. By the 20th it dropped to tropical storm intensity and before the day was through it turned extratropical.

While Abby was becoming extratropical in the East China Sea, Ben was organizing between the Marshall and Mariana Is. On the 23d Ben roared through the Marianas as a typhoon. The typhoon reached a peak on the 25th when maximum winds were estimated at 125 kn with gusts to 150 kn. Ben was beginning to recurve. On the 26th the storm headed toward the north northeast. It maintained typhoon(fig. 19) strength into the 30th. However, vertical shearing in the upper atmosphere was causing a weakening at a time when Ben was undergoing an extratropical transition.

Casualties -- Most of the incidents involving typhoon Abbey were groundings. Near Taiwan, groundings included the MCDERMOTT DERRICK BARGE NO. 29, and the SOUTH PACIFIC QUEEN. The tug NUSA ENDE was reported aground as was the NICOL, south of Shanghai on the 20th. At berth in Taichung the bulk carrier LENDOUDIS EVANGELOS II received damage during the typhoon passage. A radio report from the CATHY MYLO H2PE indicated that on the 18th she was having difficulty in maintaining control in

70-kn winds and heavy seas some 20 mi east of Lan Yu Is.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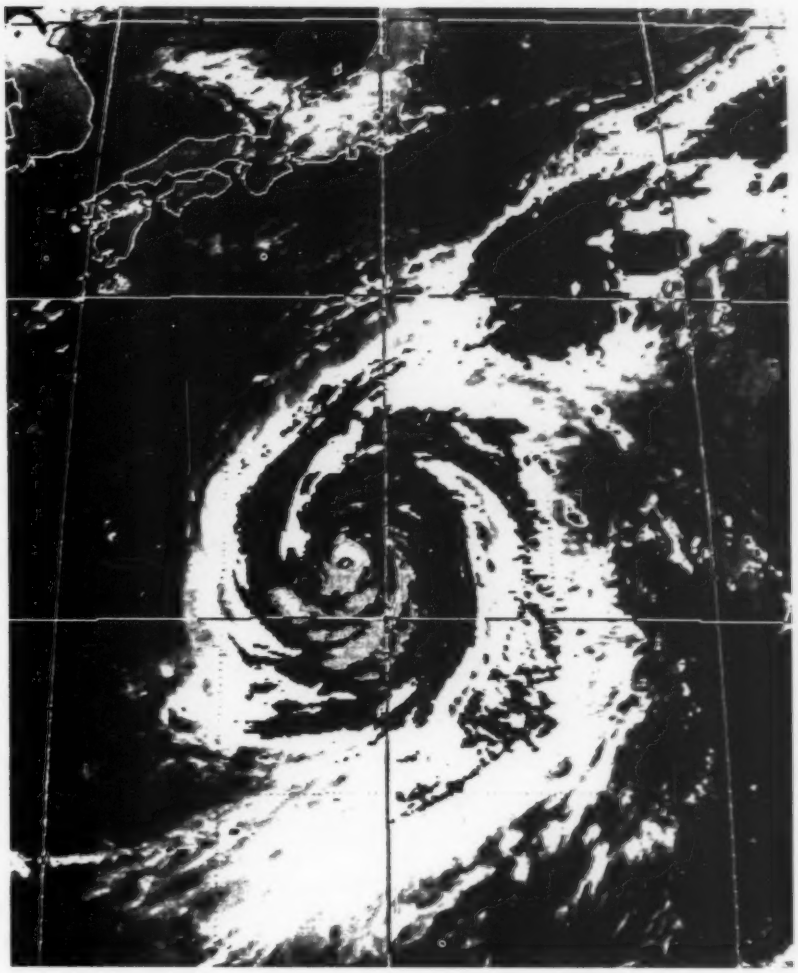
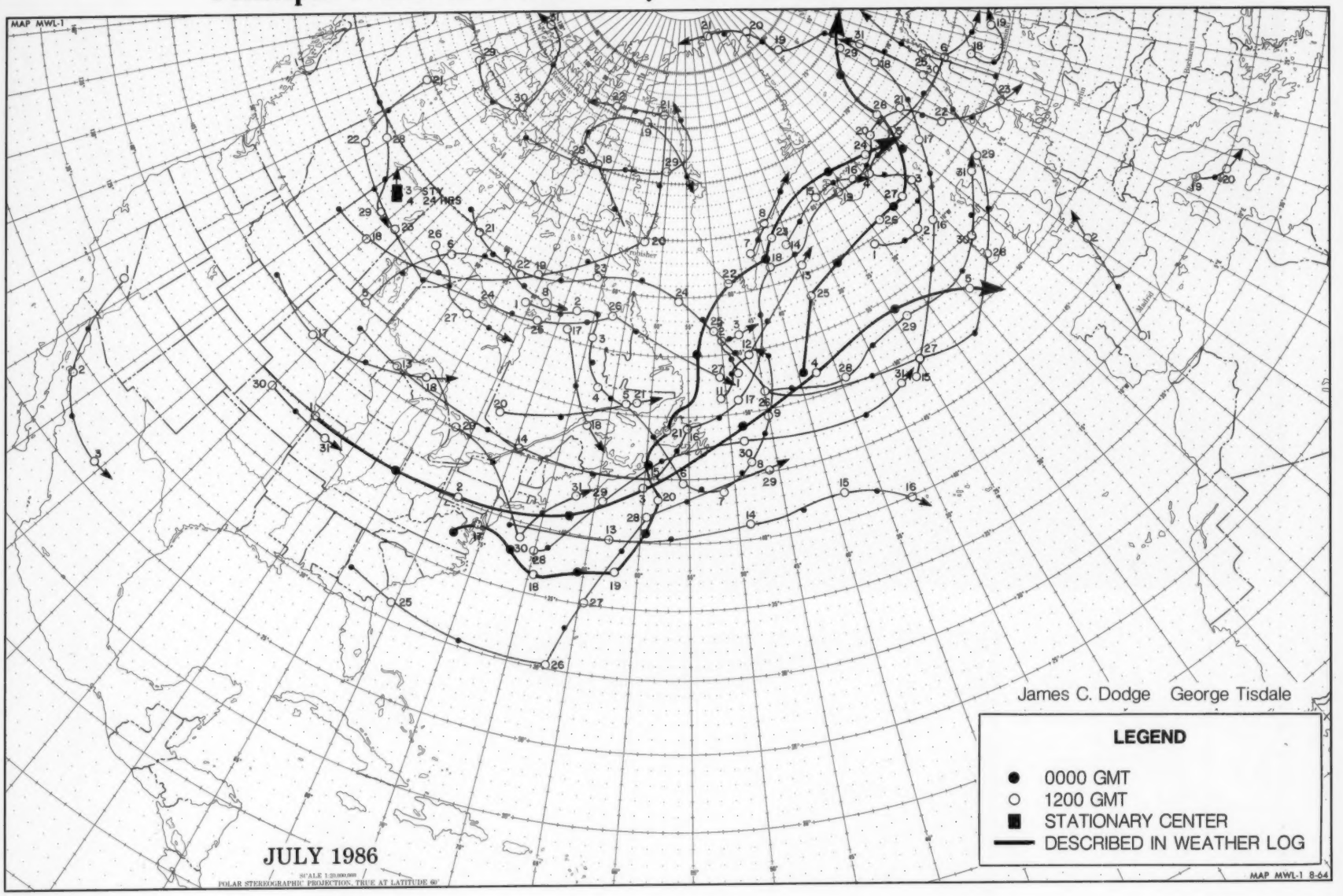


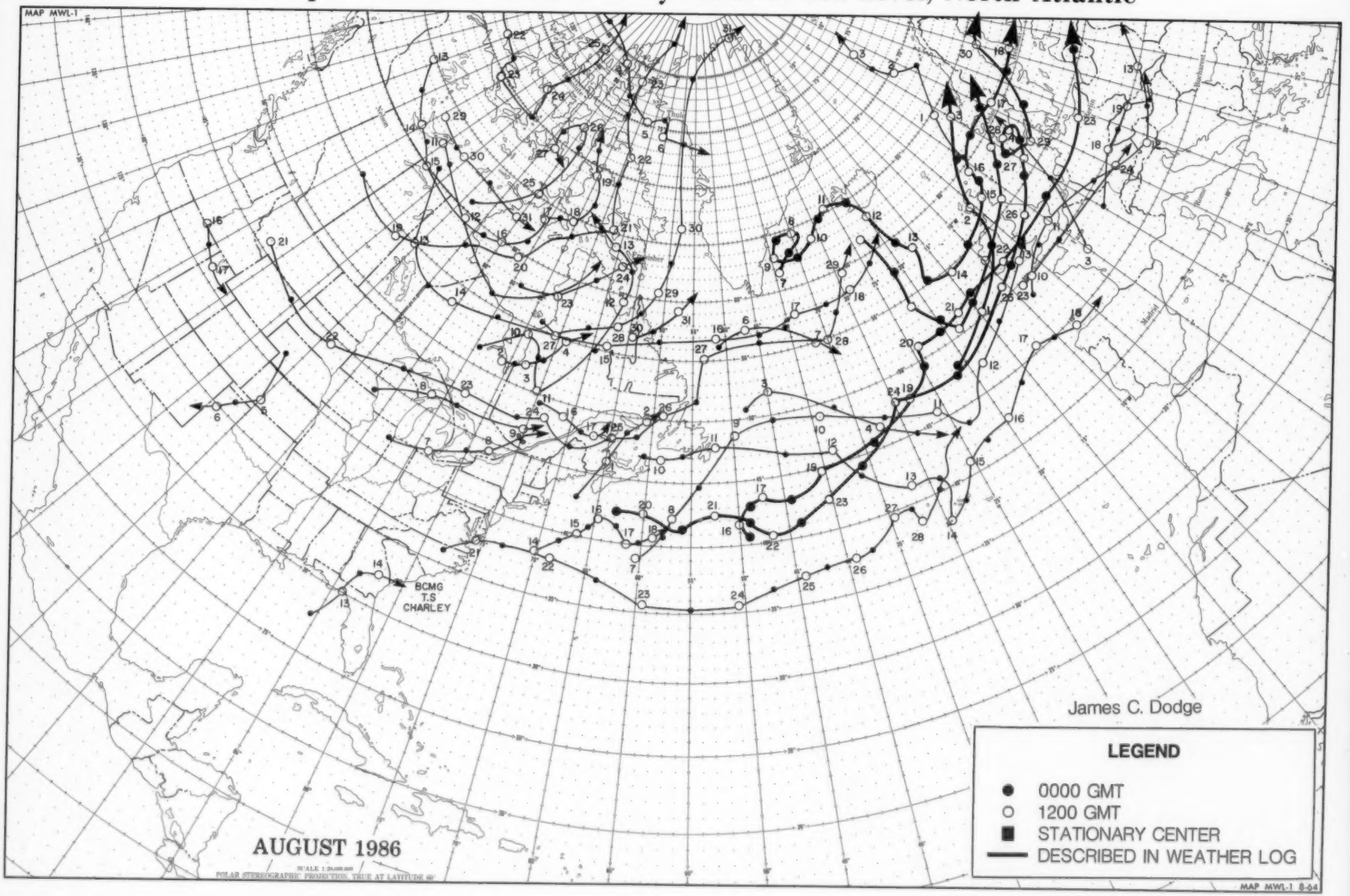
Figure 19. -- A dramatic IR portrait of Ben at 1200 on the 26th. Satellite Applications Lab.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

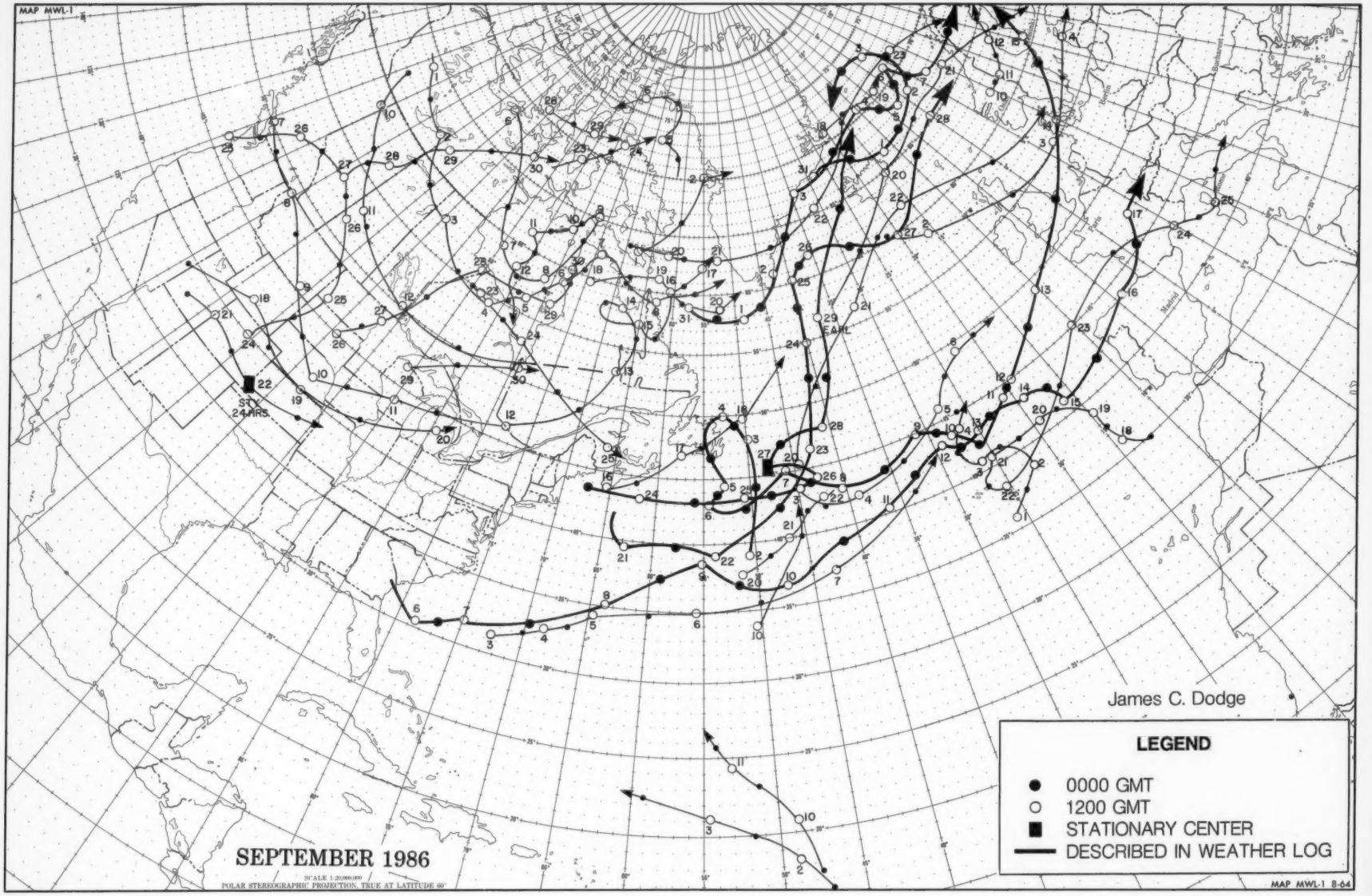


Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

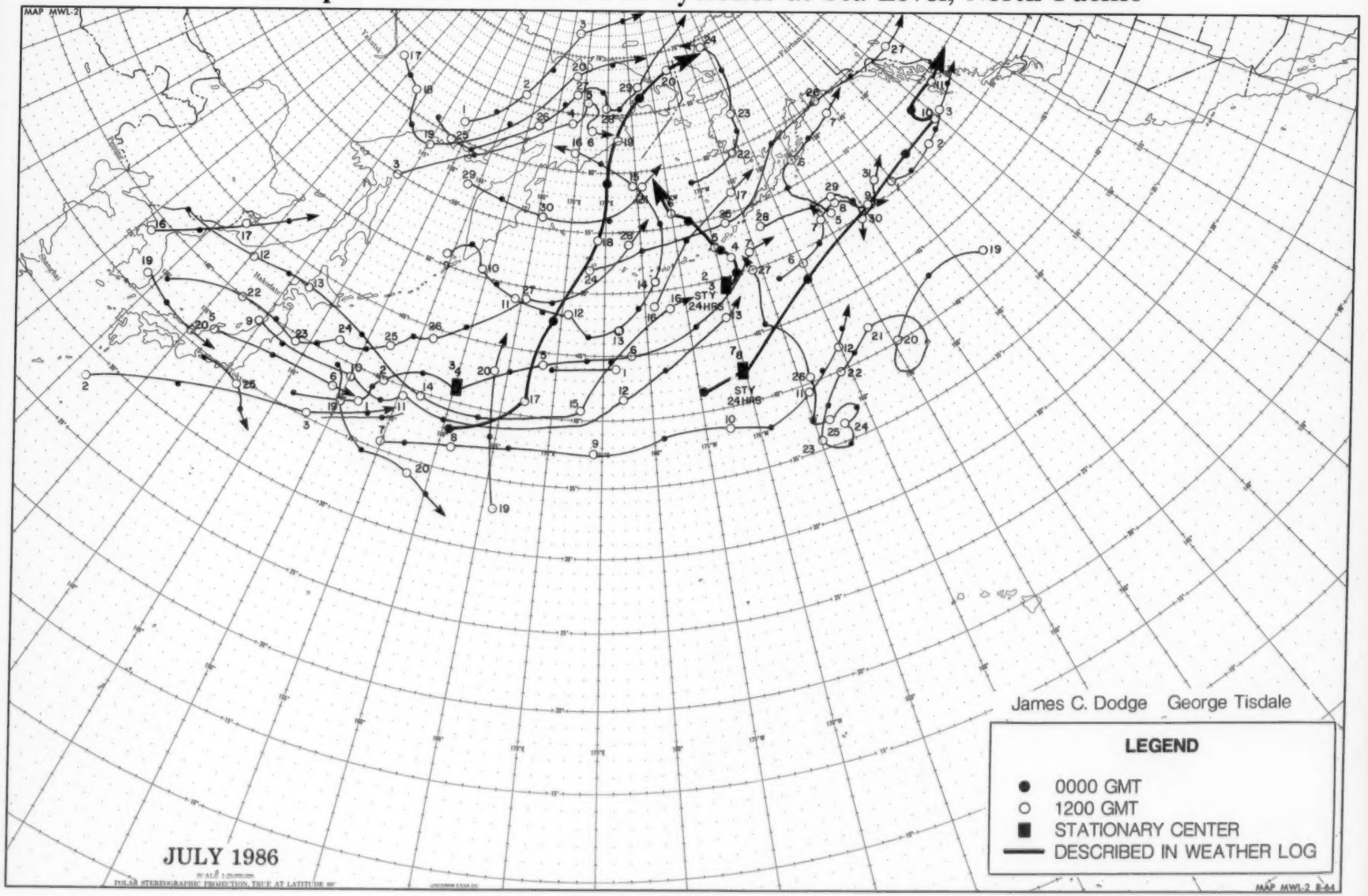
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



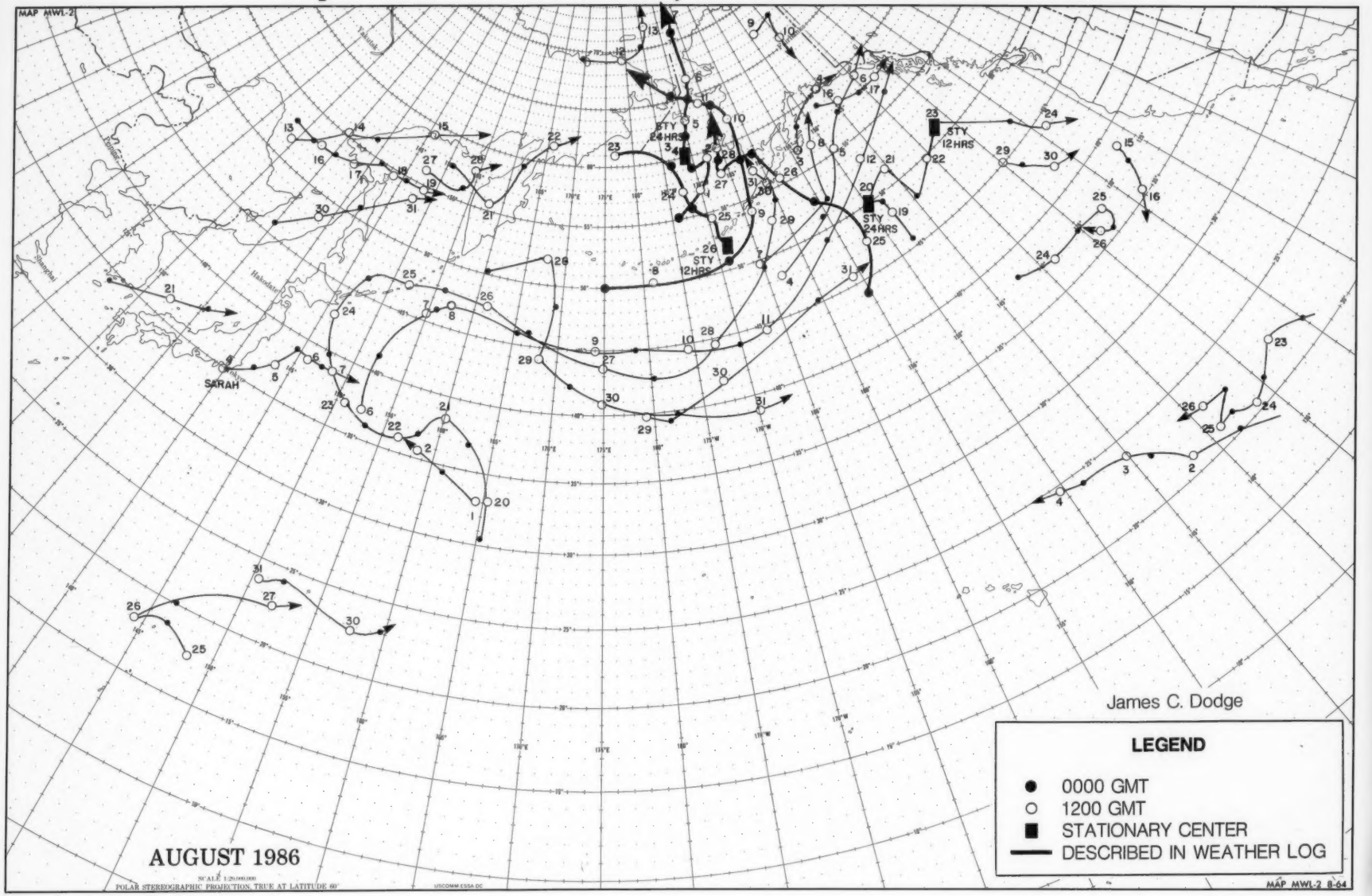
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



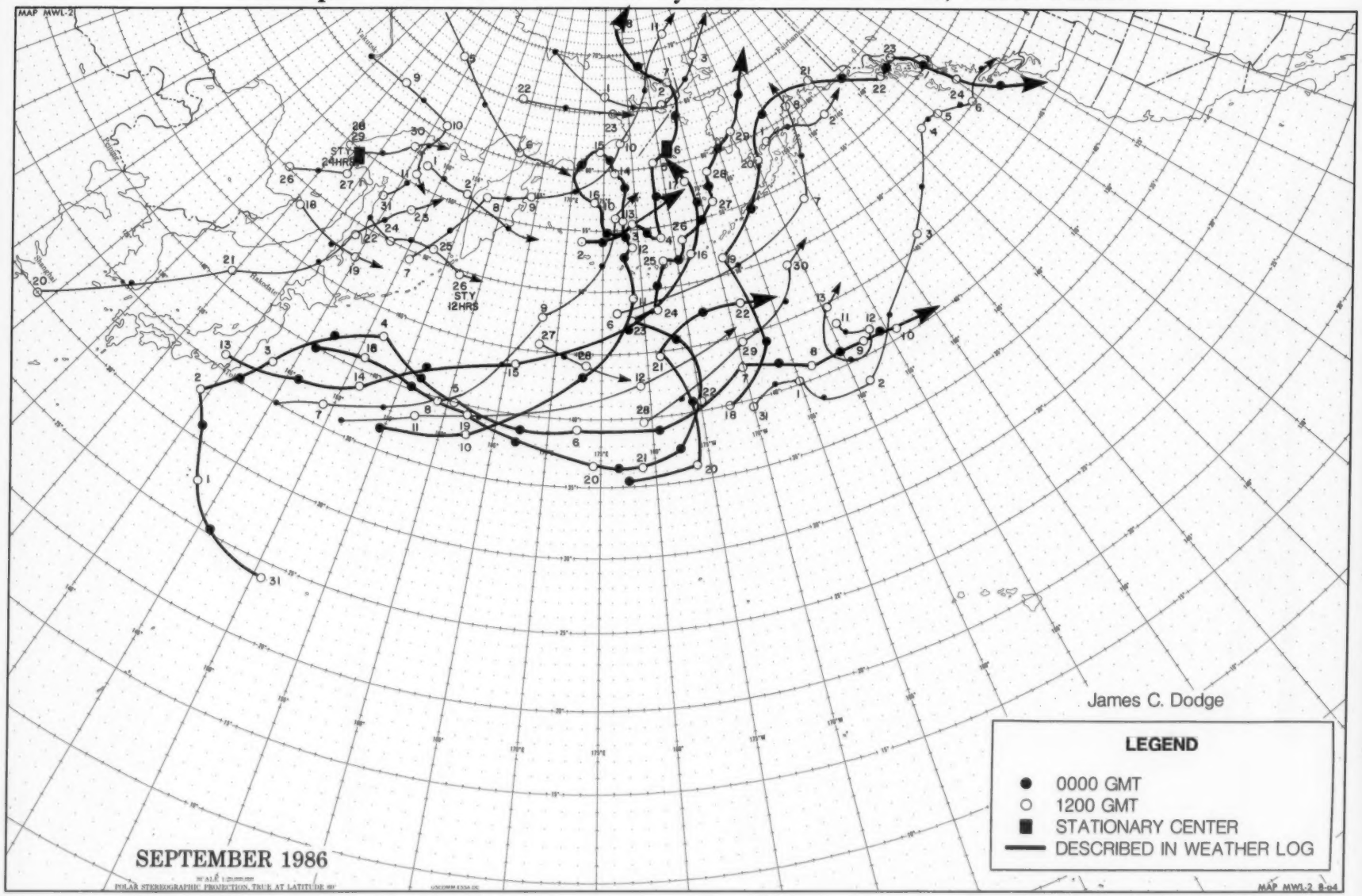
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



North Pacific Selected Gale and Wave Observations

July, August and September 1986

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C.		Sea Waves†		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
	PACIFIC	JULY															
PRESIDENT HOOVER	WTST	2	49.2 N	167.7 W	06	10	M 45	.5 NM		0994.0	6.7	8.3	6	16.5	10	7	19.5
PRESIDENT PIERCE	WUBV	16	28.0 N	130.8 E	06	18	40	5 NM	02	1005.2	27.8	28.3	5	10	18	8	21
PALM ACE	3EPZ2	19	37.7 N	153.0 E	06	10	M 40	2 NM	64	1000.0	18.0	22.8	13	18	15	15	24.5
	PACIFIC	AUG.															
SKOUBORD	LION	4	34.2 N	139.4 E	06	01	M 50	50 YD	65	0989.0	21.0	25.0	15	23			
SKOUBORD	LION	4	35.0 N	141.7 E	18	14	M 41	50 YD	65		24.0	27.0	15	23			
PRESIDENT WASHINGTON	WHRN	6	27.0 N	125.5 E	06	16	40	2 NM	81	0992.9	23.9	27.8	5	16.5	27	12	29.5
AMERICA SUN	WNEJ	6	41.2 N	125.3 W	06	34	40	2 NM	10	1013.0	12.0	12.2	4	6.5	34	6	21
AMERICAN MARKETER	WPGJ	17	15.5 N	138.2 E	12	22	40	5 NM		1000.2	27.8	29.4	4	19.5			
AMERICAN MARKETER	WPGJ	17	15.8 N	137.4 E	18	22	42	5 NM	21	0998.5	27.8	29.4	4	19.5			
PRESIDENT MADISON	WCIP	18	22.3 N	159.3 E	00	24	M 40	5 NM	16		28.3	26.1	6	13	22	10	19.5
PRESIDENT WASHINGTON	WHRN	22	25.7 N	121.6 E	06	04	M 40	1 NM	65	0998.0	24.4	30.6	6	14.5	02	9	19.5
GLOBAL FRONTIER	H3AU	24	43.7 N	155.5 W	18	10	M 50	.25 NM		1009.5	17.0	16.0	8	16.5	10	9	19.5
GLOBAL FRONTIER	H3AU	25	43.4 N	154.0 W	06	18	M 45	.25 NM		1008.2	16.5	15.5	7	19.5	18	8	21
VERREZANO BRIDGE	JBXJ	25	42.3 N	156.3 W	06	29	M 45	2 NM	25		17.0	17.5	7	19.5	26	8	19.5
PRESIDENT WASHINGTON	WHRN	27	28.6 N	127.6 E	12	17	40	2 NM	25	0996.5	27.5	29.4	6	19.5	21	11	32.5
	PACIFIC	SEP.															
SEA DIAMOND	3FJR2	4	43.2 N	146.2 E	06	06	M 47	.25 NM	63	1000.0	13.0	13.0	7	19.5	06	8	18
OYUI SKAGERAK	OUVB	16	48.3 N	169.3 W	18	17	M 63	1 NM	64	1003.0	12.5	12.0	10	19.5	18	10	19.5
PRESIDENT MONROE	WNRD	16	25.8 N	122.3 E	18	03	M 40	10 NM	03	1005.0	26.1	25.6	4	16.5	07	6	24.5
PRESIDENT MONROE	WNRD	17	27.8 N	126.4 E	06	04	M 50	5 NM		1003.0	25.0	26.0	4	16.5	01	8	23
LING LEO	WDZB	17	26.4 N	124.1 E	12	01	M 47	1 NM	60	1002.0	26.0	27.2	XX	21	36	6	21
PRESIDENT MONROE	WNRD	17	29.0 N	128.5 E	12	04	M 40	2 NM		1004.2	25.0	26.7	4	14.5	02	7	19.5
QUATSINO SOUND	ELAW3	17	26.5 N	122.9 E	18	02	M 45	2 NM		1003.5	23.0		6	26			
QUATSINO SOUND	ELAW3	18	26.0 N	122.1 E	00	02	M 44	2 NM		1003.5	24.5		6	29.5			
QUATSINO SOUND	ELAW3	19	22.3 N	120.1 E	06	27	M 40	.5 NM		0994.5	23.5	26.0	6	26			
LARS MAERSK	OXMD	21	38.6 N	164.1 E	00	30	M 50	5 NM		1006.2	21.2		7	13	04	10	24.5
LARS MAERSK	OXMD	21	38.6 N	166.3 E	05	04	M 41	10 NM		1005.8	18.4		7	11.5	07	10	19.5
OVERSEAS BOSTON	KRDB	23	50.3 N	134.1 W	18	30	40	5 NM	16	0995.6	12.2	15.0	5	10	30	8	23
	WXBZ	23	54.2 N	140.4 W	18	30	50	5 NM	25	0990.5	10.6	12.8	9	23			
EXXON NORTH SLOPE	KHLC	23	54.4 N	138.5 W	21	29	M 48			0986.5	12.8	12.8	6	11.5	29	12	29.5
MOBIL ARCTIC	KSPY	23	52.6 N	135.8 W	23	31	45	5 NM	27	0989.0	12.2	11.1	5	8	31	10	32.5
TONSONIA	KJDG	24	49.2 N	133.7 W	00	30	M 42	5 NM		0993.0	12.2	15.6	4	13	30	6	29.5
OVERSEAS BOSTON	KRDB	24	49.3 N	133.2 W	00	31	45	5 NM		0994.6	10.0	15.0	5	10	31	7	23
EXXON NEW ORLEANS	WNDM	24	44.7 N	129.5 W	00	33	M 40	5 NM	02	1002.0	16.0	17.8	6	13	32	9	23
	WXBZ	24	54.4 N	140.8 W	00	31	55	5 NM	07	0992.2	10.6	10.6	11	32.5			
TONSONIA	KJDG	24	49.7 N	134.0 W	06	31	M 44	5 NM		0992.5	12.2	15.5	3	13	30	6	29.5
MOBIL ARCTIC	KSPY	24	52.0 N	134.1 W	06	31	40	5 NM	64	0987.0	12.8	12.2	5	8	31	10	32.5
	WXBZ	24	54.6 N	141.3 W	06	31	45	5 NM	01	0997.5	11.1	10.6	10	24.5			
OVERSEAS BOSTON	KRDB	24	47.5 N	131.5 W	09	30	40	5 NM	18	0994.9	10.5	15.0	5	10	30	8	23
TONSONIA	KJDG	24	50.0 N	134.4 W	12	33	M 43	5 NM		0988.9	12.8	14.4	4	13	30	12	34.5
MOBIL ARCTIC	KSPY	24	51.3 N	132.7 W	12	35	40	5 NM	81	0984.1	12.2	12.2	4	6.5	31	10	29.5
	WXBZ	24	54.6 N	142.0 W	12	31	45	5 NM		1001.9	10.0		10	24.5			
GALVESTON	KBGA	24	57.8 N	145.8 W	18	31	50	10 NM	02	1001.4	13.3	11.7	6	32.5	31	8	32.5
TONSONIA	KJDG	25	50.8 N	135.4 W	00	32	M 40	5 NM		0996.0	13.3	13.9	4	11.5	33	9	24.5
OVERSEAS BOSTON	KRDB	25	44.9 N	129.2 W	00	31	40	5 NM		0995.6	13.9	18.0	5	10	31	9	29.5
	WXBZ	25	55.3 N	144.1 W	00	21	45	5 NM		1004.2	10.0	10.0	8	19.5			
TONSONIA	KJDG	25	51.7 N	136.2 W	06	32	M 40	5 NM		0998.0	12.2	13.9	4	11.5	33	9	26
OVERSEAS BOSTON	KRDB	25	43.6 N	128.2 W	06	33	40	5 NM		0999.3	15.0	18.0	5	10	32	9	23
FEDERAL FRASER	6ZTO	26	43.8 N	161.7 W	00	14	M 50	2 NM		1007.0	17.8	14.0	6	23			
MOBIL ARCTIC	KSPY	30	19.7 N	106.5 W	21	09	40	2 NM	82	1003.9	27.2	26.7	4	6.5	12	10	19.5

U.S. Voluntary Observing Ship Weather Reports

Last issue we did not receive the list of cooperating ships in time for publication. Below is the summary for the 3-mo period, April-June, 1986. Anyone wishing the complete listing can write to the Mariners Weather Log for a copy.

Summary: Grand Total via radio: 39,386
Grand Total via mail: 61,958
Total Unique Observations: 80,389

North Atlantic Selected Gale and Wave Observations
July, August and September 1986

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves†		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
	ATLANTIC	JULY															
TFL EXPRESS	9VPU	19	40.7 N	56.7 W	18	12	40	1 NM	62	1005.0	22.0	24.9	XX	18	13	XX	23
	ATLANTIC	AUG.															
	WZJE	1	50.0 N	15.0 W	12	30	40	5 NM	25	0981.5	16.7	14.4	8	19.5	30	30	11.5
LYRA	WSDG	6	49.8 N	09.7 W	06	23	45	5 NM		1007.0	17.5		8	16.5	23	23	26
LYRA	WSDG	6	49.6 N	09.5 W	12	25	45	5 NM		1010.0	15.5		10	16.5	25	15	37.5
LYRA	WSDG	6	49.4 N	10.2 W	18	27	40	5 NM		1013.0	16.0		10	19.5	27	26	32.5
BONITA	ELAN2	20	48.2 N	26.9 W	18	30	M 40	2 NM	15	1005.5	15.0		6	13	33	10	19.5
EVER SHINE	HPET	21	42.5 N	57.7 W	12	02	M 40			1015.0	17.7	23.0	10	19.5	01	11	23
SANKO NOBLE	ELDZ7	21	38.8 N	55.5 W	18	34	M 41	5 NM	18	1008.5	24.0	26.0	7	10	17	10	23
ADABELLE LYKES	WPFZ	22	34.7 N	51.8 W	12	70	45	5 NM	01	1009.0	26.1	26.0	5	19.5	30	9	32.5
S.S. ROVER	KRBS	22	36.8 N	50.3 W	16	31	40	5 NM		1004.0	20.0	23.3	6	16.5	32	10	23
GREEN WAVE	KRHL	23	72.8 N	57.9 W	06	17	40	2 NM	11	1004.0	3.3		5	6.5	18	6	19.5
GREEN WAVE	KRHL	23	72.5 N	57.6 W	09	17	42	2 NM	12	1007.5	3.3		4	6.5	17	5	19.5
SEALAND VENTURE	KLJH	25	49.7 N	07.9 W	12	18	45	1 NM	80	0995.0	16.1	16.1	5	13	18	10	26
	ATLANTIC	SEP.															
FEDERAL SEAWAY	KEBA	15	45.6 N	13.3 W	18	04	M 45	1 NM	51	1008.0	14.0	15.6	5	16.5	04	8	23
FEDERAL SEAWAY	KEBA	16	44.5 N	14.7 W	00	04	M 40	5 NM	02	1010.0	16.0	15.6	5	16.5	04	6	23
TFL INDEPENDENCE	9VVK	16	36.8 N	25.2 W	06	29	40	2 NM	52	1014.3	18.5	23.0			02	8	19.5
FEDERAL SEAWAY	KEBA	16	43.2 N	16.7 W	06	04	M 40	5 NM		1013.7	16.0	18.3	5	16.5	04	10	19.5
USCGC UNIMAK (WTR 379)	NBVG	16	41.9 N	66.9 W	20	22	M 43	2 NM		1011.0	14.0	15.6	8	19.5	29	4	10
SEALAND PIONEER	WSVB	19	45.5 N	39.3 W	06	14	M 45			1017.0	20.0		8	19.5	18	8	26
SEALAND PIONEER	WSVF	19	46.5 N	34.8 W	18	17	M 40	5 NM	02	1027.0	20.0		8	16.5	17	6	26
SEALAND LEADER	WSNH	26	39.4 N	49.5 W	06	24	M 60	2 NM	97	1002.0	20.0		8	10	25	15	19.5
RAINBOW HOPE	KNDB	28	48.9 N	49.0 W	12	34	46	5 NM	50	0990.7	10.0	12.2	7	10	34	13	36
RAINBOW HOPE	KNDE	29	50.2 N	47.9 W	00	28	44	5 NM	07	0993.9	6.7	7.8	6	8	29	13	23

BATHY-TESAC Data Received at NMC
July, August and September 1986

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
C6BY	19	10	9	***
C6D6	105	41	64	HUDSON
C6DV	221	221	0	W. TEMPLEMAN
C62683	27	27	0	ALFRED NEEDLER
C62958	43	43	0	J.P.TULLY
C8BL	32	32	0	***
C7C	318	0	318	OCEAN STATION CHARLIE
C7L	118	118	0	OCEAN STATION LIMA
DBBX	22	22	0	GAUSS
DBFJ	10	10	0	FRITHJOF
DBFR	133	133	0	ANTHON DOHRN
DBKV	86	86	0	SEETEUFEL
DCH	11	11	0	ELBE I
DCL	3	3	0	FEHMARNBELT-FEUERSCHIFF
DDNA	43	43	0	JEBSEN SOUTHLAND
DESI	93	93	0	VALDIVIA
DGFR	11	11	0	MONTE OLIVIA
DGLM	71	71	0	MONTE ROSA
DGRL	40	40	0	RIKA
DGSR	22	22	0	MONTE SARMIENTO
DGVK	61	61	0	COLUMBIA VICTORIA
DGZV	39	39	0	COLUMBUS VIRGINIA
DHCW	65	65	0	COLUMBUS WELLINGTON
DSCW	1	1	0	***
D5NZ	96	96	0	POLYNESIA
D9HF	1	1	0	***
ELBX3	27	27	0	PACKING
ELDWB	72	72	0	***
EREA	183	101	82	MONSOON
EREB	267	40	227	VOLNA
EREC	106	0	106	PRYLYV
EREI	169	83	86	OCEAN
ERES	153	96	57	VICTOR BUGAEN
ERET	59	58	1	GEORGE OUSHAKOV
ESGG	218	108	110	FROLOV VYACHESLAV
EXIT	9	9	0	***
FNBF	8	8	0	ROSTAND
FNCJ	2	2	0	OBERNAI
FNCO	1	1	0	PAUL HEROULT
FNCU	1	1	0	***
FNCW	38	38	0	ROUSSEAU
FNFU	15	15	0	EL MANSOUR
FNGS	51	51	0	LAFAYETTE
FNIB	52	52	0	THALASSA
FNOM	42	42	0	ANGO
FNPA	29	29	0	***
GACA	27	27	0	***
GDTC	3	3	0	CALIFORNIA STAR
GOVL	18	18	0	ACT 4
GOVM	41	41	0	DILKARA
GOVN	22	22	0	ACT6
GZKA	23	23	0	ACT 3
HCGT	17	17	0	BUCCANEER
HCJH	1	1	0	ISLA FLOREANA

Bathy-Tesac Data Cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
HPAN	17	17	0	MICRONESIAN COMMERCE
HPEW	10	10	0	PACIFIC ISLANDER
H98Q	23	23	0	MICRONESIAN INDEPENDENCE
JBES	47	47	0	YAMASHIN MARU
JBMS	15	15	0	HIKAWA MARU
JBOA	67	67	0	KEIFU MARU
JCDF	43	43	0	SOYO MARU
JCDT	2	2	0	AMERICA MARU
JCIN	10	10	0	TOKYO MARU
JCLL	51	51	0	LIONS GATE BRIDGE
JCOD	20	20	0	SHOYO
JDOC	18	18	0	HIEI MARU
JEMM	16	16	0	ASIA MARU
JFDG	120	120	0	SHUMPU MARU
JFZG	23	23	0	HAKUSAN MARU
JGWV	1	1	0	***
JGZK	58	58	0	RYOFU MARU
JHJE	36	36	0	QUEENS WAY BRIDGE
JIOW	31	31	0	ALASKA MARU
JJZC	6	6	0	HAKONE MARU
JNVF	142	142	0	KAIYO MARU
JPQX	100	100	0	CHOFU MARU
JPVB	102	102	0	SEIFU MARU
JPZG	2	2	0	***
JQXW	2	2	0	HIERU MARU
KEOC	97	97	0	EDGAR M. QUEENY
KGWU	19	19	0	WASHINGTON,T.
KIYO	5	5	0	EXXON JAMESTOWN
KNBD	130	130	0	DELAWARE II
KRJG	2	2	0	***
KVWA	34	34	0	TEXAS CLIPPER
LZTI	54	54	0	***
MOP13	1	1	0	***
NAOD	16	16	0	JARVIS
NAWR	2	2	0	***
NBTM	9	9	0	POLAR STAR
NENC	3	3	0	SEALIFT PACIFIC
NGDF	77	77	0	MUNRO
NHPA	17	17	0	STARK
NHTE	4	4	0	ELROD
NHWR	13	13	0	MIDGETT
NIKA	70	70	0	SEALIFT ATLANTIC
NJOR	12	12	0	GALLATIN
NLVS	15	15	0	RUSH
NMST	7	7	0	MAHLON S. TISDALE
NPCR	11	11	0	DALLAS
NRFJ	48	48	0	NORTHWIND
NYGG	20	20	0	CHAUVENET
NZXF	7	7	0	SAMPSON
OXYL	7	7	0	BAMSA DAN
PGDG	77	77	0	NEDLLOYD KINGSTON
PGDU	78	78	0	NEDLLOYD KIMBERLEY
PGOF	44	44	0	NEDLLOYD KEMBLA

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
PJYG	58	58	0	OLEANDER
PLAT	213	213	0	PLATFORM
RB3063	1	1	0	***
SCOR	3	3	0	TV 241
SCOU	6	6	0	TV 243
SCOV	7	7	0	TV 244
SCPE	10	10	0	TV 253
SCPH	4	4	0	TV 257
SCPK	2	2	0	TV 260
SCQG	3	3	0	TV 245
SEXH	2	2	0	***
SEXN	9	9	0	TV 227
SEXQ	5	5	0	TV 278
SEZA	1	1	0	TV 276
SGQJ	26	26	0	ELGAREN
SHIP	986	986	0	NO SHIP CALL SIGN REC'D
SHPF	2	2	0	TV 281
SJTR	1	1	0	TV 271
SKPV	1	1	0	***
SKVP	12	12	0	TV 284
SKVQ	2	2	0	***
SMZQ	4	4	0	TV102
SPCH	1	1	0	***
SQPK	1	1	0	***
TEST	65	62	3	***
TESTP	2	2	0	***
TFEA	8	8	0	BJARNI SAEMUNDSSON
TFXQ	16	16	0	RAKKAFOSS
UAAX	108	51	57	VOYKOV
UEAK	166	77	89	VALERIAN URYVAYEV
UHQC	1	0	1	***
UHQS	166	82	84	ACADEMIC KOROLEV
UJFQ	73	73	0	MULTANOVSKIY PROF
UMAY	241	108	133	ACADEMIC SHIRSHOV
UMFW	30	30	0	PROF. ZUBOV
UNAC	1	1	0	SHOKALSKEY
UNAQ	1	0	1	***
UNQV	1	1	0	***
UPUI	294	196	98	PROFESSOR VIZE
URYM	62	0	62	RUDOLF SAMOILOVICH
USQP	25	0	25	NIKOLAI KONONOV
UUPB	224	135	89	AKADEMIK N. SHOKALSKIY
UUPW	1	0	1	***
UUQR	25	24	1	MOLCHANOV PAVEL PRO
UVMM	116	73	43	YAKOV GAKKEL
UWEC	61	37	24	KHROMOV PROFESSOR
UZGH	47	43	4	PASSAT
VCBT	37	37	0	CAPE ROGER
VKCK	125	125	0	STUART
VKCN	171	171	0	CANBERRA
VKCV	153	153	0	DERWENT
VKDA	105	105	0	DARWIN
VKLA	207	207	0	ADELAIDE

Bathy-Tesac Data Cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VKLB	37	37	0	HOBART
VKMC	1	1	0	PALUMA
VKMK	138	138	0	***
VKML	179	179	0	SNIPE
VKMN	142	142	0	TEALE
VKMS	303	303	0	COOK
VKPT	112	112	0	PERTH
VLNB	302	302	0	TORRENS
VMAP	105	105	0	AUSTRALIAN PROGRESS
VXN	145	145	0	AIRCRAFT
WCGN	26	26	0	CHEVRON CALIFORNIA
WECB	2	2	0	MELVILLE
WMVC	30	30	0	J.N.COBB
WMVF	102	102	0	ALBATROSS IV
WSC2276	5	5	0	***
WTDF	106	106	0	T. CROMWELL
WTDK	179	179	0	D.S. JORDAN
WTDL	1	1	0	***
WTDM	38	38	0	M.FREEMAN
WTDO	33	33	0	OREGON II
WTEA	34	34	0	DISCOVERER
WTEB	31	31	0	FAIRWEATHER
WTED	97	97	0	CHAPMAN

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
WTEF	10	10	0	RAINIER
WTEG	16	16	0	MOUNT MITCHELL
WTEJ	230	230	0	MCARTHUR
WTEK	21	21	0	DAVIDSON
WTEP	36	36	0	OCEANOGRAPHER
WTER	65	65	0	RESEARCHER
WTES	67	67	0	SURVEYOR
WTEW	4	4	0	WHITING
WXBR	39	39	0	CHEVRON MISSISSIPPI
WXQ7334	16	16	0	PETER ANDERSON
WYA4674	8	8	0	***
WYB8082	18	18	0	DAY STAR
WYR9891	17	17	0	SEA HAVEN
Y3CH	13	0	13	PROF. ALBRECHT PENCK
3FHI2	92	92	0	MOANA PACIFIC
5LFX	11	11	0	PACBARONESS
5NCB	20	20	0	PACMERCHANT
5NTA	14	14	0	PACMONARCH
7JBJ	2	2	0	RICHMOND BRIDGE
7JOB	9	9	0	SHINKASHU MARU
7KDD	14	14	0	YOKO MARU
7LAY	3	3	0	***
8JIF	16	16	0	SHUNYO MARU
8JNZ	153	153	0	KOFU MARU

TOTAL BATHYS RECEIVED 10332
TOTAL TESACS RECEIVED 1788
TOTAL REPORTS RECEIVED 12120

☆ DON'T LEAVE PORT WITHOUT IT ☆

U.S. Voluntary Observing Ship Weather Reports

July, August and September 1986

SHIP NAME	VIA RADIO	VIA MAIL
1ST LT ALEX BONNYMAN	17	27
2ND LT. JOHN P. BOBO	26	17
ACADIA FOREST	64	103
ACE ACCORD	74	146
ACT 111	158	
ACT 5	152	
ACT 7	130	
ACT I	10	
ACT IV	139	
ADABELLE LYKES	114	173
ADDIRIYAH	53	60
ADM. WM. M. CALLAGHAN		4
ADMIRALTY BAY	74	121
AFRIC STAR	35	
AFRICAN ADDAX	8	13
AGNES FOSS		37
AL AHMADIAH	47	101
ALAMEDA	75	138
ALASKA MARU	68	
ALASKA RAINBOW	57	73
ALBERT MAERSK	1	
ALBULA	9	42
ALEMANIA EXPRESS	59	
ALLIGATOR GLORY	29	71
ALLIGATOR HOPE	12	36
ALMUDENA	12	107
ALTAIR	20	13
ALTAMONTE	2	2
ALTIMIRA	2	31
ALVA MAERSK	20	26
AMBASSADOR BRIDGE	109	39
AMELIA TOPIC	28	92
AMERICA EXPRESS	45	
AMERICA SUN	45	87
AMERICAN ALABAMA	74	201
AMERICAN APOLLO	2	26
AMERICAN AQUARIUS	34	101
AMERICAN ASTRONAUT	46	168
AMERICAN CALIFORNIA	35	105
AMERICAN CONDOR	55	74
AMERICAN CORMORANT	21	27
AMERICAN EAGLE	16	
AMERICAN ENTENTE	79	155
AMERICAN ENVOY	64	173
AMERICAN FALCON	65	160
AMERICAN GEORGIA	53	144
AMERICAN HARRISON	19	37
AMERICAN HAWAII	39	123
AMERICAN ILLINOIS	26	42
AMERICAN KENTUCKY	7	
AMERICAN LANCER	23	69
AMERICAN LARK	26	72
AMERICAN LEGION	3	
AMERICAN LYNX	54	127
AMERICAN MAINE	49	65
AMERICAN MARINER		67
AMERICAN MARKETER	31	132
AMERICAN MERCHANT	86	223
AMERICAN MICHIGAN	28	58
AMERICAN NEBRASKA	15	20
AMERICAN NEW JERSEY	12	39
AMERICAN NEW YORK	16	147
AMERICAN NORTH CAROLIN	25	
AMERICAN OHIO	50	103
AMERICAN OKLAHOMA	22	73
AMERICAN PIONEER	53	170
AMERICAN PURITAN	32	132
AMERICAN REPUBLIC		44
AMERICAN RESOLUTE	21	84
AMERICAN TROJAN	17	56
AMERICAN UTAH	28	
AMERICAN VETERAN	27	14
AMERICAN VIRGINIA	10	43
AMERICAN WASHINGTON	27	49
AMERICANA	24	
AMOCO BALTIMORE	3	7
AMOCO CAIRO	3	
AMOCO SAVANNAH	2	
AMOCO YORKTOWN	6	15
ANDERS MAERSK	33	93
ANDERSON		77
AQUA CITY	141	163
AQUA GARDEN	63	148
AQUARIUS	17	27
ARCHON	16	15
ARCO ALASKA	29	25
ARCO ANCHORAGE	26	36
ARCO CALIFORNIA	24	33
ARCO JUNEAU	33	41
ARCO PRUDHOE BAY	40	42
ARCO SAG RIVER	32	30
ARCO SPIRIT	16	7
ARCO TEXAS	14	46
ARCTIC TOKYO	2	204
ARGONAUT	28	88
ARILD MAERSK	19	41
ARMAND HAMMER	2	46
AROSIA	25	34
ARTHUR M. ANDERSON	22	1
ASHLEY LYKES	17	24
ASIA MARU	43	
ASIA WINDS	89	
ASIAN EXPRESS	33	49
ASIAN HIGHWAY	165	63
ASIAN VENTURE	24	11
ASPEN	45	86
ASTORIA	74	123
ASYA	13	32
ATIGUN PASS	117	269
ATLANTIC	19	40
ATLANTIC RAINBOW	25	93
ATLANTIC SAGA	58	
ATLANTIC SONG	41	
ATLANTIC SPIRIT	16	23
ATLANTIC STAR	110	
AUSTANGER	17	
AUSTRAL RAINBOW	6	44
AUSTRALIA	93	
B.T. ALASKA	8	91
B.T. SAN DIEGO	128	227
BALLARD		16
BALTIMORE TRADER	52	35
BARCZAN	23	
BARBER NARA	7	
BARBER PERSEUS	55	
BARBER PRIAM	2	
BARBER TAMPA	10	
BARBER TEXAS	32	
BARBER TOBA	34	
BARRYDALE	31	
BAY BRIDGE	77	144
BEAUTEOUS	17	
BEISHU MARU	125	5
BENNINGTON	35	61
BERNINA	34	126
BHARATENDU	20	
BHAVABHUTI	30	
BIBI	75	
BISLIG BAY	104	282
BLUE COSMO	52	27
BOEFJORD	7	45
BOGASARI DUA	4	79
BOGASARI EMPAT	43	239
BOGASARI LIMA	25	
BOHEME	16	
BONITA	1	
BORINQUEN	58	213
BRINTON LYKES	33	25
BROOKLYN		23
BROOKS RANGE	14	60
BUNGA KESIDANG	58	
BUNGA MELATI	43	291
BURNS HARBOR		167
CALANUS		52
CALCITE II	58	55
CALIFORNIA RAINBOW	38	38
CAP ANAMUR	11	
CARLA A. HILLS	28	181
CARMEN	51	62
CASON J. CALLAWAY	15	28
CAVALIER		69
CAVARA	22	42
CENPAC 2	38	71
CGM LORRAINE	22	
CHARLES M. BLEGHLEY	41	53
CHARLES PIGOTT		109
CHARLOTTE LYKES	64	175
CHARLOTTE MAERSK	27	115
CHASTINE MAERSK	28	112
CHELSEA	45	120
CHEMICAL PIONEER	61	119
CHERRY VALLEY	11	86
CHESAPEAKE	18	31
CHESAPEAKE TRADER	31	151
CHESNUT HILL	7	18
CHEVRON ANTWERP	11	35
CHEVRON APIZONA	4	
CHEVRON ARNHEM	1	
CHEVRON BURNABY	36	195
CHEVRON CALIFORNIA	131	142
CHEVRON COLORADO	26	45
CHEVRON COPENHAGEN	36	248
CHEVRON EDIMBURGH	21	84
CHEVRON EQUATOR	35	261
CHEVRON FELUY	19	166
CHEVRON FRANKFURT	5	
CHEVRON LONDON		193
CHEVRON LOUISIANA	8	27
CHEVRON MISSISSIPPI	160	209
CHEVRON OREGON	6	7
CHEVRON PACIFIC	23	223
CHEVRON SOUTH AMERICA		7
CHEVRON WASHINGTON	63	100
CHRISTINA	105	
CHUEN ON	25	
CINTA	25	41
CITADEL HILL	17	
CITY OF MIDLAND	86	293
CLARA MAERSK	24	84
CLEMENTINA	5	
CLIFFORD MAERSK	52	154
CLOVER TRUST	40	83
CO-OP EXPRESS II	109	37
CO-OP EXPRESS V	43	31
COLIMA	6	71
COLORADO HIGHWAY	54	22
COLUMBIA STAR		141
COLUMBUS AMERICA	173	
COLUMBUS AUSTRALIA	80	
COLUMBUS CALIFORNIA	62	

SHIP NAME	VIA RADIO	VIA MAIL
COLUMBUS LOUISANA	77	
COLUMBUS NEW ZEALAND	15	
COLUMBUS VICTORIA	83	
COLUMBUS VIRGINIA	119	
COLUMBUS WELLINGTON	154	
COLUNBIA STAR	15	
CONDORA	1	
CONTINENTAL HIGHWAY	61	
COOP GRAIN #2	10	
COPIAPU	20	49
CORNELIA MAERSK	52	167
CORNUCOPIA	45	68
CPL. LOUIS J. HAUGE JR	38	28
CRYSTAL STAR	31	75
CUPRENT	67	104
D.L. BOWER		84
DACEBANK	87	
DAMIAO DE GOIS	86	
DANDY #1	2	
DART AMERICA	85	
DAWN	73	146
DEL SUR	30	105
DELAWARE TRADER	58	
DIANA	3	44
DILKARA	3	
DOCK EXPRESS TEXAS	2	120
DOCTOR LYKES	25	90
DOMINA	43	67
DRAGOR MAERSK	17	65
DUBHE	27	66
DUSSELDORF EXPRESS	49	
DYUI SKAGERAK	25	288
DYVI KATTEGAT	20	209
EASTERN FRIENDSHIP	53	119
EASTERN GLORY	34	154
EASTERN MAID	1	
EASTERN MOON	1	
EASTERN ROYAL	18	26
EASTERN VENTURE	21	10
EDGAR B. SPEER		77
EDGAR M. QUEENY	27	
EDWIN H. GOTT		77
ELBE EXPRESS	1	
ELTON HOYT II		34
ENDEAVOR	13	68
ERLANGEN EXPRESS	31	
ERNEST R. BREECH	99	156
ESTHER SCHULTE	37	184
EVER GENIUS	6	
EVER GENTRY		9
EVER GIANT	21	63
EVER GLEAMY	4	39
EVER GLOBE	16	99
EVER GLORY	13	19
EVER GOLDEN	6	
EVER GOODS		46
EVER GOVERN	6	
EVER GRACE	43	
EVER GRADE	18	118
EVER GRAND	8	34
EVER GROWTH	6	17
EVER GUARD	15	
EVER GUIDE	6	2
EVER LEVEL	17	61
EVER LINKING	1	24
EVER LIVING	9	25
EVER LYRIC	6	
EVER SHINE	25	41
EVER SPRING	40	65
EVER SUMMIT	43	77
EVER SUPERB	16	34
EVER VALOR	39	179
EVER VALUE	12	31
EVER VIGOR	13	31
EVER VITAL	15	
EXPORT CHALLENGER	29	90
EXPORT CHAMPION	21	89
EXPORT FREEDOM	24	101
EXPORT PATRIOT	33	97
EXXON BALTIMORE	8	14
EXXON BATON ROUGE	29	58
EXXON BAYTOWN	10	36
EXXON BENICIA	20	44
EXXON BOSTON	57	47
EXXON HOUSTON	18	29
EXXON JAMESTOWN	30	38
EXXON LEXINGTON	34	46
EXXON NEW ORLEANS	41	47
EXXON NORTH SLOPE	27	39
EXXON PHILADELPHIA	34	22
EXXON PRINCETON	4	67
EXXON SAN FRANCISCO	12	20
EXXON WASHINGTON	6	11
EXXON YORKTOWN		9
F.P.CONVEYOR	2	
FALCON CHAMPION	3	
FALCON LEADER	43	
FALSTAFF		20
FALSTRIA	20	38
FEDERAL FRASER	60	165
FEDERAL LAKES	16	27
FEDERAL SEAWAY	52	117
FERNCROFT	169	158
FESTIVALE	7	50
FETISH	54	150
FLORIDA RAINBOW	10	121
FOREST WAY	98	193
FORTALEZA	108	197
FRANCIS SINCERE NO. 6	50	2
FROTASIRIUS	22	85
GALLEON AQUAMARINE	13	39
GALVESTON	43	111
GAMA GETAH	1	
GAS LIBRA	9	
GAZANIA	67	23
GEMINI	104	73
GENERAL M.BELGRANDO	5	
GENEVIEVE LYKES	20	110
GENISTA	18	87
GEORGE A. SLOAN	81	52
GEORGE A. STINSON		152
GEORGE H. WEYERHAEUSER	23	94
GEORGE WASHINGTON BRID	5	
GERONIMO		11
GLACIER BAY	31	94
GLOBAL FRONTIER	58	109
GLOBAL PIONEER	42	46
GLOBAL SPLENDOR	57	125
GLORIOUS SPICA		20
GOLDEN BLISS	56	105
GOLDEN GATE BRIDGE	103	63
GOLDEN GRAMPUS	34	
GOLDEN HAWK	41	169
GOMA	1	
GREAT LAND	120	
GREAT OCEAN	71	121
GREEN FOREST	25	22
GREEN HARBOUR	86	63
GREEN ISLAND	29	14
GREEN KOBE	53	83
GREEN MASTER	69	181
GREEN MAYA	28	28
GREEN SASEBO	65	100
GREEN STAR	50	31
GREEN VALLEY	65	75
GREEN WAVE	27	49
GUAICURI	52	
GULF IDEAL	26	77
GYPSUM COUNTESS	240	
GYPSUM KING	222	
H. LEE WHITE		132
H.J. HAYNES		73
HAKUSAN MARU	97	
HANJIN BUSAN	5	
HANJIN CHEJU		14
HANJIN INCHEON	1	6
HANJIN KWANGYANG	25	46
HANJIN LONG BEACH	8	6
HANJIN NEW YORK		9
HANJIN POHANG	25	
HANNOVER	2	
HASSAN MERCHANT	3	22
HEERENGRASHT	86	
HENRY FORD II		12
HERBERT C. JACKSON	39	74
HERMENIA	40	37
HIEI MARU	133	
HIKAWA MARU	100	
HIRA MARU	124	
HOEGH CLIPPER	17	26
HOEGH DRAKE		2
HOEGH DUKE	97	
HOEGH MARLIN	14	39
HOEGH MASCOT	5	83
HOEGH MINERVA	20	101
HOEGH MIRANDA	57	144
HOHSING ARROW	44	16
HOHSING BREEZE	16	55
HOLIDAY	14	51
HOMERIC	43	50
HONOLULU	109	
HOYO MARU	7	
HUAL TRACER	13	
HYUGA MARU	90	
HYUNDAI #1	21	30
HYUNDAI #7		14
HYUNDAI CON SEVEN	3	17
INCOTRANS PACIFIC	44	
INCOTRANS SPIRIT	49	
INGER	60	233
IRVING ARCTIC	54	
IRVING MIAMI	18	
ISLAND HOPE		191
ISLAND PRINCESS	80	
ITALICA	23	69
IVAN TOPIC	15	
IZOLA	64	42
J.A.W. IGLEHART	9	106
J.L. MAUTHE	70	125
J.T. HIGGINS		161
JADRAN	4	146
JALAGOVIND	11	
JALAMOKAMBI	11	
JALAPA	4	44
JALAVIHAR	16	
JALAVIJAYA	1	
JALISCO	32	
JAMES LYKES	29	52
JAMES R. BARKER		189
JAPAN ALLIANCE	51	24
JAPAN APOLLO	108	73
JEAN LYKES	4	
JOHN A. MCCONE		206
JOHN G. MUNSON	54	78
JOHN LYKES	43	49
JOSEPH L. BLOCK		115
JOSEPH LYKES	4	57
JOVIAN LILY	37	28
JOVIAN LUZON	20	56
JUBILEE	47	145
KALIDAS	18	
KAMNIK	1	
KASINA	54	
KASTURBA	55	
KAUAI	57	200
KEE LUNG	42	78
KEN TRADER	78	133
KENAI	30	88
KENNETH E. HILL	52	194
KENNETH T. DERR	30	62
KENT	79	143
KEYSTONE CANYON	21	96
KEYSTONER	53	148
KISO MARU	81	
KITTANNING	28	39
KNORR	31	
KOFUKU MARU	18	52
KOLN EXPRESS	60	
KOREAN JACEWON	26	42
KOREAN WONIS JIN	22	25

SHIP NAME	VIA RADIO	VIA MAIL
KOREAN WONIS ONE	23	16
KOREAN WONIS SEVEN	23	39
KOREAN WONIS SUN	31	32
KRPAN	6	
KUROBE MARU	128	
LA PAMPA	17	
LAKE SUWA	40	49
LAKES STAR	1	
LANAI	13	
LANCASHIRE	1	
LARS MAERSK	79	177
LASH PACIFICO		23
LAURA MAERSK	34	103
LAUST MAERSK	37	97
LEDA MAERSK	30	87
LEISE MAERSK	33	91
LEO TEMPEST	24	52
LERMA	69	
LESLIE LYKES	17	123
LETITIA LYKES	21	12
LEWIS WILSON FOY		205
LEXA MAERSK	36	100
LICA MAERSK	62	79
LILLOOET	69	141
LING LEO	48	114
LIONS GATE BRIDGE	134	
LNG TAURUS	54	139
LONGEVITY	23	49
LOTUS ACE	112	
LOUIS MAERSK	46	156
LOUISE LYKES	71	129
LOUISIANA MAMA	65	190
LPG HARDANGER		202
LT. ODYSSEY	26	31
LUCENT STAR	27	
LUCOR MANOR	1	
LURLINE	61	217
LUZON	33	44
LUZON VICTORY	14	
LYRA	61	119
M. P. GRACE	14	
MADANG	12	
MAERSK WAVE	64	138
MAERSK WIND	49	141
MAHARSHI KARVE	1	
MAJ SANDVED	17	28
MAJ. STEPHEN W. PLESS	5	
MALLORY LYKES	17	62
MANGAL DESAI	50	92
MANUKAI	89	204
MANULANI	40	162
MARABANK	18	30
MARATHA MARINER	21	16
MARATHA PROVIDENCE	17	
MARATHA SHOGUN	18	
MARCHIONESS	20	95
MARGARET LYKES	76	119
MARIA TOPIC	48	31
MARITIME NOBLE	74	
MARJORIE LYKES	26	
MARTHA R. INGRAM	71	88
MAUI	53	205
MAURICIO DE OLIVEIRA	1	
MC KINNEY MAERSK	34	86
MEDALLION	46	153
MELVILLE	12	
MENINA BARBARA	28	38
MERAK EIGHTY	13	17
MESABI MINER		109
MICROBA	87	106
MICRONESIAN COMMERCE		30
MICRONESIAN INDEPENDEN	139	121
MIDDLETOWN	58	77
MIHO MARU	1	
MILTA	71	143
MING GALAXY	2	
MING GLORY	8	
MING MOON	7	19
MING OCEAN	24	22
MING SPRING	10	
MING STAR	2	
MING SUN	25	
MING UNIVERSE	3	13
MOANA PACIFIC	118	173
MOBIL ARCTIC	38	157
MOBIL MERIDIAN	85	186
MOKU PAHU	164	187
MONISBON	3	
MORMACSKY	42	117
MORMACSTAR	14	
MORMACSUN	19	130
MOSEL EXPRESS	133	
MOUNT VERNON VICTORY	86	212
MV TRUDY	65	50
MYRON C. TAYLOR	46	65
NACIONAL SANTOS	9	4
NANCY LYKES	9	95
NATIONAL DIGNITY	32	57
NATIONAL HONOR	4	31
NATIONAL PRIDE	1	66
NAVIGATOR		113
NEDLLOYD ELBE	64	
NEDLLOYD KEMBLA	112	
NEDLLOYD KIMBERLEY	142	
NEDLLOYD KINGSTON	161	
NEDLLOYD ROCHESTER	138	
NEDLLOYD ROSARIO	64	
NEDLLOYD ROTTERDAM	157	
NEDLLOYD ROUEN	129	
NEPTUNE AMBER	131	240
NEPTUNE CORAL	32	
NEPTUNE DIAMOND	186	153
NEPTUNE IVORY	58	26
NEPTUNE PEARL	52	161
NEPTUNE TOURMALINE	14	
NEW CAMELLIA	18	33
NEW HORIZON		146
NEW INDEPENDENCE	63	181
NEW JERSEY MARU	145	
NEW YORK MARU	113	
NEWARK	2	
NISSAN LAUREL	27	
NISSAN MARU	64	
NOAA DAVID STARR JORDA	172	95
NOAA SHIP ALBATROSS IV	179	136
NOAA SHIP CHAPMAN	107	115
NOAA SHIP DAVIDSON	73	20
NOAA SHIP DELAWARE II	274	310
NOAA SHIP DISCOVERER 0	116	288
NOAA SHIP FAIRWEATHER	194	378
NOAA SHIP FERREL	108	130
NOAA SHIP JOHN N COBB	129	189
NOAA SHIP MCARTHUR	138	294
NOAA SHIP MILLER FREEM	91	244
NOAA SHIP MT MITCHEL	153	149
NOAA SHIP OCEANOGRAPHE	186	401
NOAA SHIP OREGON II	221	236
NOAA SHIP RAINIER	111	156
NOAA SHIP RESEARCHER	146	367
NOAA SHIP RUDE 590	94	143
NOAA SHIP SURVEYOR	95	109
NOAA SHIP T. CROMWELL	261	333
NOAA SHIP WHITING	258	284
NOORDAM	6	
NORDHVAL	122	
NORDWOGE	17	
NORWAY	18	17
NOSAC EXPRESS	14	
NOSAC SEL	15	53
NOSAC TRIGGER	35	
NOSAC VERDE	9	60
NUESTRA SENORA D ROSAR	14	51
OAK PEARL	66	
OAK SUN	18	
OAKLAND	207	225
OBERON	16	30
OCEAN CHEER	10	
OCEAN COMMANDER #1	6	59
OCEAN DIANA	19	
OCEAN STEELHEAD	31	
OCTA	23	25
OJI GLORIA	59	
OLEANDER	213	230
OLGA TOPIC	5	
OMI DYNACHEM	53	74
OMI YUKON	5	17
ORANGE BLOSSOM	65	103
OREGON RAINBOW	21	55
ORIENTAL DIPLOMAT	48	
ORIENTAL EDUCATOR	45	202
ORIENTAL EXECUTIVE	38	179
ORIENTAL EXPLORER	18	162
ORIENTAL KNIGHT	32	50
ORIENTAL MINISTER	6	46
ORIENTAL PATRIOT	11	12
ORIENTAL PRINCE	29	
ORIENTAL TAIO	42	
ORION HIWAY	37	49
OVERSEAS ALICE	33	9
OVERSEAS ARCTIC	112	201
OVERSEAS BOSTON	112	220
OVERSEAS CHICAGO	33	79
OVERSEAS JUNEAU	50	104
OVERSEAS MARILYN	36	101
OVERSEAS OHIO	26	42
OVERSEAS VALDEZ	30	
OVERSEAS VIVIAN	13	41
OVERSEAS WASHINGTON	45	194
PACBARON	19	
PACBARONESS	12	12
PACDUCHESS	17	
PACDUKE	3	3
PACEMPEROR	37	38
PACGLORY	23	9
PACIFIC ANGEL	51	56
PACIFIC ARROW	131	74
PACIFIC CLIPPER	17	
PACIFIC DOWN	8	
PACIFIC HIGHWAY	107	
PACIFIC LIGHT	9	48
PACIFIC PRINCESS	1	
PACIFIC RAINBOW	45	127
PACIFIC SUNSHINE	2	
PACIFIC VENTURE	142	
PACIFIC VICTORY	27	111
PACIFIC WING	56	
PACKING	39	
PACMAJESTY	24	8
PACMERCHANT	47	16
PACMONARCH	56	1
PACNOBLE	20	11
PALM ACE	58	77
PANAMA	38	41
PANCALDO	46	59
PATRIOT	55	44
PAUL BUCK	54	105
PAUL BUNYAN	80	150
PAUL H. TOWNSEND	1	9
PAUL PIGOTT	1	
PAUL THAYER		30
PEGGY DOW	136	
PENNSYLANIA RAINBOW	19	
PERUVIAN REEFER	31	31
PFC EUGENE A. OBREGON	36	108
PFC WILLIAM B. BAUGH	29	36
PFC. JAMES ANDERSON JR	33	57
PHILADELPHIA	63	191
PHILADELPHIA SUN	3	6
PHILIPPINE VICTORY	10	80
PILAR	2	128
PING CHAU		8
PLANTIN	84	
POLAR ALASKA	19	237
POLYNESIA	145	69
PONCE	42	96
POQUITA MAMI	114	284
PORTLAND	53	77

SHIP NAME	VIA RADIO	VIA MAIL
POTOMAC TRADER	41	136
PRESIDENT ADAMS	40	124
PRESIDENT CLEVELAND		87
PRESIDENT EISENHOWER	156	199
PRESIDENT F. ROOSEVELT	107	167
PRESIDENT GRANT	60	99
PRESIDENT HOOVER	75	142
PRESIDENT JACKSON	24	42
PRESIDENT JEFFERSON	92	235
PRESIDENT JOHNSON	117	210
PRESIDENT KENNEDY	41	64
PRESIDENT LINCOLN	71	153
PRESIDENT MADISON	114	292
PRESIDENT MC KINLEY	103	275
PRESIDENT MONROE	107	190
PRESIDENT PIERCE	58	281
PRESIDENT TAFT	41	45
PRESIDENT TAYLOR	22	37
PRESIDENT TYLER	63	158
PRESIDENT VAN BUREN	19	19
PRESIDENT WASHINGTON	202	206
PRESIDENT WILSON	52	82
PRESQUE ISLE		101
PRINCE OF TOKYO	84	121
PROSPERIDAD	59	137
PUNTA ANCLA	25	28
PUNTA BRAVA	42	54
PVT HARRY FISHER	12	32
QUATSINO SOUND	103	263
QUEEN ELIZABETH 2	110	
QUEEN OPAL	72	
QUEENS WAY BRIDGE	95	
RAFAELA	24	
RAINBOW BRIDGE	18	18
RAINBOW HOPE		223
RED ARROW	47	
REGINA MAERSK	30	106
RHEIN EXPRESS	115	
RICHARD G MATTIESEN	119	177
RIO ESQUEL	69	
RIO FRIO	50	
RIO LIMAY	34	15
RIO TEUCO	3	
ROBERT CONRAD		77
ROBERT E. LEE	22	32
ROMAN REEFER		34
ROSARIO DEL MAR	11	40
ROSINA TOPIC	8	134
ROTTERDAM	30	
ROYAL PRINCESS	83	
ROYAL VIKING STAR	2	
RUTH LYKES	47	53
S.S. BAYAMON	22	73
S.S. ROVER	28	110
S.S.TONSINA	1	
S.T. CHAPO	6	
SAM HOUSTON	24	21
SAMOAN REEFER	12	56
SAMRAT ASHOK	30	
SAN JUAN	97	204
SAN MATEO VICTORY	3	
SAN PEDRO	34	161
SANKO CYCLAMAN	2	
SANKO CYRSTAL	15	
SANKO ETERNITY	10	
SANKO HAWK	10	7
SANKO HELIANTHUS	27	
SANKO HIBISCUS		20
SANKO HONOR		30
SANKO IPIS	1	
SANKO LAPIS	51	
SANKO LILY	46	58
SANKO NOBLE	34	45
SANKO PEACE	11	110
SANKO PEACOCK	8	15
SANKO PEARL	21	
SANKO STAR	24	
SANKO STORK	11	66
SANKO SWIFT		165
SANSINENA II	1	
SANTA ADELA	104	122
SANTA CRUZ	100	196
SANTA CRUZ II	37	
SANTA JUANA	122	182
SATSUNA MARU	82	28
SATURN DIAMOND	40	
SAUDI DIRIYAH	45	
SAVONITA	36	230
SCANDINAVIAN HIGHWAY	163	
SEA BELLS	28	49
SEA DIAMOND	64	153
SEA FAN	64	159
SEA FORTUNE	23	163
SEA HAVEN		23
SEA JADE	54	76
SEA LANTERN	8	104
SEA LIGHT	43	135
SEA QUEEN	4	
SEALAND ADVENTURER	46	109
SEALAND BOSTON	1	
SEALAND CONSUMER	69	171
SEALAND DEFENDER	45	172
SEALAND DEVELOPER	70	189
SEALAND ECONOMY	61	169
SEALAND ENDURANCE	38	175
SEALAND EXPLORER	51	147
SEALAND EXPRESS	75	191
SEALAND FREEDOM	70	161
SEALAND INDEPENDENCE	75	130
SEALAND INNOVATOR	64	153
SEALAND LEADER	45	212
SEALAND LIBERATOR	48	100
SEALAND MARINER	36	129
SEALAND PACER	30	197
SEALAND PATRIOT	52	165
SEALAND PIONEER	38	109
SEALAND PRODUCER	54	139
SEALAND VENTURE	60	209
SEALAND VOYAGER	118	215
SEDCO/BP 471	71	92
SELVA	6	
SENATOR	1	
SEVEN OCEAN	23	22
SGT. METEJ KOCAK	27	46
SHELDON LYKES	68	
SHELLY BAY	23	60
SHENAHON	20	26
SHIN BEISHU MARU	41	
SHINKASHU MARU	77	
SHIRLEY LYKES	23	35
SILVER CLIPPER	63	30
SILVER SHINKO		3
SINGAPORE VICTORY		28
SIOUX TATE	31	
SKAUGRAN	74	147
SKOUBORD	29	117
SOARER CUPID	43	147
SOLON TURMAN	14	34
SONG OF NORWAY	11	
SOPHIA	106	
SOUTHERN VIRGO	61	194
SOUTHLAND STAR	168	
SOUTHWARD	213	225
SPIRIT OF LIBERTY	7	
SPRING BIRD	11	
SPRING BREEZE		93
ST. CLAIR		170
ST. LOUIS	30	91
STAR DIEPPE	78	
STAR DOVER	46	
STAR EAGLE	26	47
STAR HONGKONG	65	90
STAR KANDA	36	17
STAR OF TEXAS	1	
STARWARD	32	
STELLA LYKES	29	
STEWART J. CORT		219
STOLT LION	1	
STONEWALL JACKSON	30	26
STRATHCONON	132	
STREAM BUSUANGA	51	
STUTTGART EXPRESS	45	
SUGAR ISLANDER	14	76
SUN PRINCESS	15	
SUN VIKING	8	
SUNBELT DIXIE	149	181
SYOSSET	12	24
TAI CORN	9	
TAI SHING	14	
TARGET	68	150
TENCHBANK	24	
TESTER	67	170
TEXACO CONNECTICUT	2	
TEXACO FLORIDA	2	
TEXACO GEORGIA	1	37
TEXACO MISSISSIPPI		3
TEXAS CLIPPER	24	67
TFL DEMOCRACY	9	125
TFL ENTERPRISE	25	67
TFL EXPRESS	32	143
TFL FRANKLIN	28	
TFL FREEDOM	18	134
TFL INDEPENDENCE	35	83
TFL JEFFERSON	40	70
TFL LIBERTY	49	144
THOMAS G. THOMPSON	180	268
THOMAS WASHINGTON	21	127
THOMPSON LYKES	9	
THOMPSON PASS	1	45
TILLIE LYKES	9	28
TOHBEI MARU	31	1
TOKYO MARU	73	
TOKYO RAINBOW	52	96
TONCI TOPIC	8	157
TONIC VENTURE	28	64
TONSONIA	23	244
TOYOTA MARU 10	49	
TOYOTA MARU 11	33	
TOYOTA MARU 15	158	
TOYOTA MARU NO 17	29	
TOYOTA MARU NO 18	67	
TRAVE ORE	38	113
TRITON	3	
TROPIC SUN	2	
TROPICAL BEAUTY	1	
TROPICAL MIST		20
TROPICALE	38	35
TUNISIAN REEFER	49	51
ULTRAMAR	4	12
ULTRASEA	36	
UNICORN		63
UNITED SPIRIT	50	6
UNIVERSE	9	
USCGC ALERT (WMEC 630)	8	
USCGC BASSWOOD (WLB 38	94	110
USCGC BOUTWELL WMEC 71	92	190
USCGC BUTTONWOOD WLB 3	34	
USCGC CHASE (WMEC 718)	2	20
USCGC CHEROKEE WMEC 16	23	94
USCGC CHILULA (WMEC 15	3	
USCGC CITRUS (WMEC 300	2	
USCGC CLOVER (WMEC 292	2	
USCGC CONFIDENCE	6	88
USCGC COURAGEOUS	27	
USCGC DALLAS (WMEC 716	2	
USCGC DAUNTLESS WMEC 6	9	
USCGC DEPENDABLE	39	
USCGC DILIGENCE WMEC 6	2	
USCGC EAGLE (WIX 327)	66	120
USCGC EVERGREEN WMEC 2		18
USCGC INGHAM (WMEC 35)	8	
USCGC IRONWOOD (WLB 29	44	
USCGC JARVIS (WMEC 725	17	
USCGC KATMAI BAY	13	34
USCGC LAUREL (WLB 291)		64
USCGC LIPAN (WMEC 85)		4
USCGC MACKINAW	12	24
USCGC MALLOW (WLB 396)	60	
USCGC MIDGETT (WMEC 72	15	82
USCGC MORGENTHAU	24	

SHIP NAME	VIA RADIO	VIA MAIL
USCGC MUNRO (WHEC 724)	43	123
USCGC NORTHWIND WAGB 2	149	170
USCGC POLAR SEA WAGB 1	13	
USCGC POLAR STAR WAGB	244	250
USCGC RELIANCE WMEC 61	4	
USCGC RESOLUTE WMEC 62	7	
USCGC RUSH (WHEC 723)	2	33
USCGC SALVIA (WLB 400)	6	
USCGC SEDGE (WLB 402)	9	
USCGC STEADFAST WMEC 6	72	
USCGC STORIS (WMEC 38)	1	
USCGC SUNDEW (WLB 404)	12	52
USCGC SWEETBRIER WLB 4	40	
USCGC TAMAROA (WMEC 16	1	
USCGC TAMPA WMEC 902	49	
USCGC TANEY (WHEC 37)	4	
USCGC UNIMAK (WTR 379)	77	82
USCGC UTE	12	95
USCGC VALIANT (WMEC 62	2	
USCGC VIGILANT WMEC 61	6	
USCGC VIGOROUS WMEC 62	3	
USCGC WOODRUSH (WLB 40	44	50
USCGC YOCONA (WMEC 168	216	
USNS ANTARES	1	
USNS APACHE (T-ATF 172	52	76
USNS BARTLETT(T-AGOR 1		46
USNS CAPELLA	3	
USNS CHAUVENET	89	174
USNS DE STEIGUER	53	111
USNS DENEBOLA		7
USNS GUS W. DARNELL	93	81
USNS HARKNESS (T-AGS 3	8	
USNS KANE TAGS 27	3	10
USNS LYNCH T-AGOR 7	70	
USNS MERCURY	47	
USNS MOHAWK (T-ATF 170	99	132
USNS NARRAGANSETT	93	140
USNS NAVAJO	17	19
USNS NEOSHO (T-AO 143)		69
USNS PASSUMPSIC TAO 10		85
USNS PAWCATUCK TAO-108		66
USNS POWHATAN TATF 166	18	72
USNS RANGE SENTINEL		19
USNS REDSTONE	24	
USNS RIGEL (T-AF 58)		76
USNS SEALIFT ANTARCTIC	96	112
USNS SEALIFT ARABIAN S	34	
USNS SEALIFT ARCTIC	44	95
USNS SEALIFT ATLANTIC	46	12
USNS SEALIFT CHINA SEA	38	25
USNS SEALIFT IND*N OCE	14	45
USNS SEALIFT MED	6	
USNS SEALIFT PACIFIC	6	19
USNS SPICA (T-AFS 9)		14
USNS VANGUARD TAG 194	40	111
USNS WACCAMAW(TAO-109)		5
USNS WILKES T-AGS-33	18	
VALLEY FORGE	16	127
VAN FORT	70	60
VAN HAWK	1	
VAN WARRIOR	22	
VELENJE	12	
VERRAZANO BRIDGE	123	64
VICTORY ACE	50	
VISHVA PANKAJ	32	107
VISHVA PAROG	25	
VISHVA PRAFULLA	18	
VISHVA SIDDHI	5	
VISHVA VIKRAM	19	
WALCHAND	76	114
WASHINGTON RAINBOW #2	50	56
WELLINGTON STAR	156	
WESER EXPRESS	1	
WESTERN HIGHWAY	47	
WESTERN SUN	30	74
WESTOCEAN	544	
WESTWARD VENTURE	31	56
WESTWOOD MERIT	1	
WILFRED SYKES	79	169
WILLIAM E. MUSSMAN	16	96
WILLIAM J. DELANCEY		164
WILLOWBANK	126	
WOLVERINE		70
YAMASHIN MARU	128	34
YAQUI		23
YE LAN	1	
YOUNG SCOPE	84	
YOUNG SPROUT	76	154
YS ARGOSY	61	
ZAPATA ARCTIC	155	
ZEELANDIA	74	
ZENIT STAR		43
ZENIT SUN	65	95
ZENIT WAVE	86	156
ZEPHUNTER	11	
ZEUS	1	
ZEYNEP-K	14	24
ZIM GENOVA	35	
ZIM HAIFA	29	
ZIM HONGKONG	44	
ZIM HOUSTON	16	
ZIM IBERIA	31	
ZIM KEELUNG	46	
ZIM MARSEILLES	23	
ZIM MIAMI	37	
ZIM NEW YORK	69	
ZIM SAVANNAH	33	
ZIM TOKYO	28	
ZOELLA LYKES	33	30

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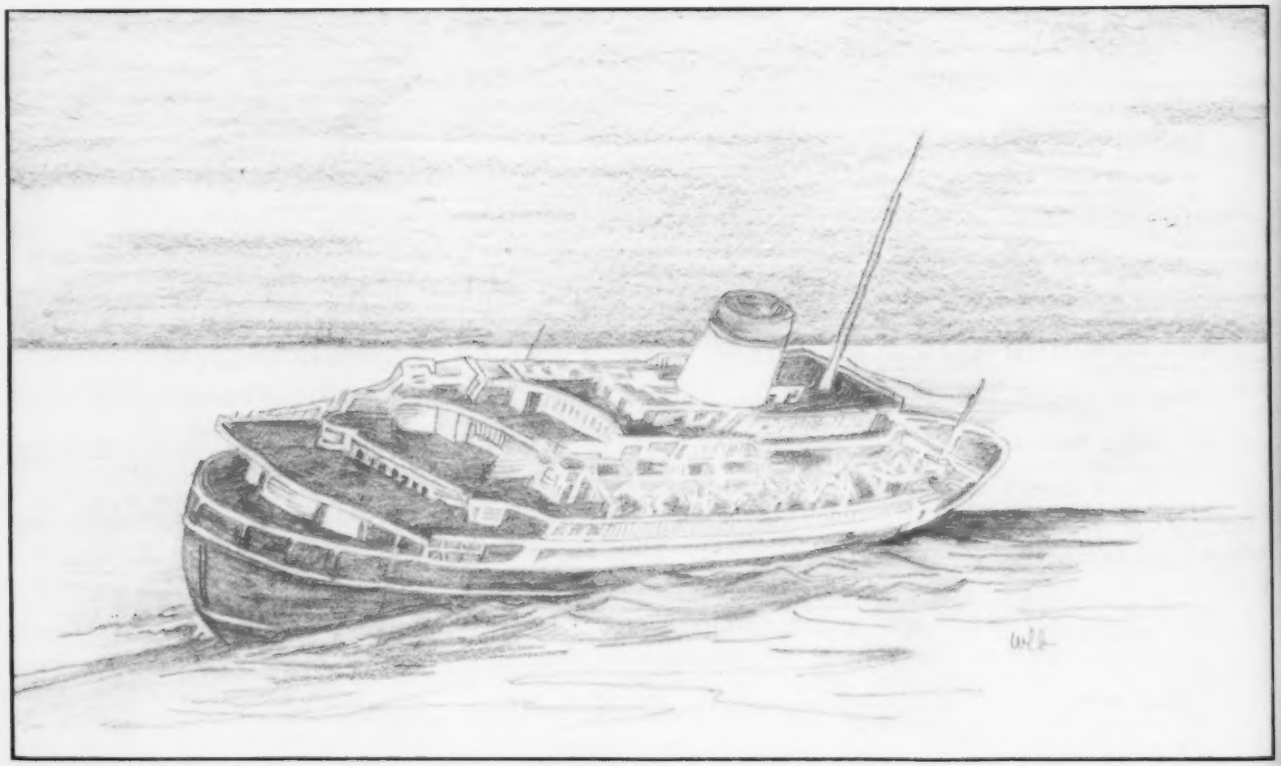

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